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National Association of Business, Economics and Technology

2020 Virtual CONFERENCE PROCEEDINGS

Editors Page

Throughout the 43-year history of the NABET/APUBEF Conference, we have striven to compile and publish the authors' papers which were presented at each of the respective conferences. Since 2013, the Proceedings has been upgraded to peer-reviewed status. Throughout the history of the NABET/APUBEF Proceedings, we have benefited from the services performed by an exceptional group of reviewers and editors.

For the 2020 Conference Proceedings, several attendees at the conference volunteered to participate in the review process. From these volunteers, we selected three individuals to participate in the peer-review process. Each of these reviewers worked diligently and selflessly in the arduous task of meticulously reviewing the various scholarly works that are presented in this Proceedings publication.

The editors acknowledge the dedication, hard work and the excellent result in which the reviewers' efforts resulted. The reviewers of the 2020 NABET Peer-Reviewed Conference Proceedings are:

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NABET 2020 Virtual CONFERENCE PROCEEDINGS

INTRODUCTION

The National Association of Business, Economics and Technology is in its forty-third year of existence. It was formerly known as APUBEF, the Association of Pennsylvania University Business and Economics Faculty. It was founded by a group of economics and business professors from the fourteen state universities comprising the Pennsylvania System of Higher Education. Their goal was to provide a platform for sharing and encouraging scholarly work among the business faculty of the fourteen state universities. As a result of their efforts, the organization has grown and has sponsored an academic conference each year for the past 43 years.

Since 2006 NABET was regional in scope and has become national in scope since the 42nd Annual Meeting and beyond. At the 43rd Annual Meeting, a Virtual Conference, the scholarly work of authors from thirteen states, and the countries of China, Portugal, Spain and Sweden representing 42 colleges and universities were presented.

At NABET, we encourage conference presenters to complete their papers and submit them for publication for this Peer-Reviewed Proceedings publication. Of the 93 papers, presented at the 43rd Annual Meeting, the following pages contain those papers that were completed by the authors and submitted to the Proceedings editors. Each paper has gone through a thorough review/edit process. *The Official Conference Program* of the 43rd Annual Meeting including the abstracts of each paper that was presented at the conference is also included.

Table of Contents

STOCK PRICE REACTIONS TO ANNOUNCEMENTS OF MERGERS AND ACQUISITIONS

Tibebe Assefa, Bowie State University
Sunando Sengupta, Bowie State University

ABSTRACT

This paper investigates whether abnormal returns exist around the announcements for Mergers and Acquisitions (M&A) that occurred from 2011 to 2019. We analyze the impact of the M&A announcements on the stock price of acquiring and acquired firms. Earlier research has shown that M&A events related to stock-generated investor reactions tend to affect the stock price of the companies involved in the M&A transactions, usually on a very short basis. When a company acquires another company, the stock price of the target company typically will rise, and the stock price of the acquiring company declines, in the short term. It is predicted, in prior research, that the target company's stock will rise because the acquiring company pays a premium for the acquisition. Amazon, Facebook, General Electric, Google and Cisco are examples of well-known companies that have participated in M&As. Our sample consists of 33 pairs of firms that announced M&As over a nine-years period from 2011-2019. We first identify the announcement or event dates and then utilize Event-Study methodology Eventus, from the Wharton Research Database (WRDS), to test for the presence of abnormal returns around the event dates. Our results show significant positive 11. 52 percent Cumulative Abnormal Returns (CAR) for the acquired firms one day before the announcement date up to the announcement date for acquired firms. On the contrary, the results show significant negative CAR of 3.72 percent for the acquiring firms from 3 days until 30 days after the announcement date, which could be due to the premium paid to acquire.

INTRODUCTION

Mergers and acquisitions are the "acts of consolidating companies or assets, with an eye toward stimulating growth, gaining competitive advantages, increasing market share, or influencing supply chains" (Palmer, 2019). Every year mergers and acquisitions are announced between an acquiring company and a targeted company. On the date of the announcement, stock prices have proven to be impacted by it. Statista shows that in 2019, the value of the global M&A deals amounted to $3.7 trillion U.S. dollars (Szmigier 2020). This makes up 4.3% of the $86 trillion in the world economy (Desjardins 2019) and it is an important corporate strategic plan for business growth and global competition. This study is important because it can give investors, business owners, and traders beneficial information to make wise business decisions, while also providing evidence of the announcement date boosting the economy.

This paper investigates the presence of abnormal returns in the stock market on the announcement date of mergers and acquisitions for publicly traded companies from 2012 to 2019, and if there are any effects post-announcement date. Prior studies have shown positive abnormal returns for the targeted company but have shown mixed returns for the acquirer. In order to conduct our study, we have researched multiple articles covering mergers and acquisitions, along with our own empirical investigations for better understanding. The stock market has always been volatile, so we can expect to find interesting results.

LITERATURE REVIEW

The literature suggest that the targeted company will experience positive abnormal returns in stock market. In contrast, the acquiring company may see no significant impact at all. Manuel and Rhoades (2014) found in their study that "the impact of the merger announcement on the target airlines is positive except for Northwest due to the weakening demand for air transport as the U.S. economy faltered at the time of its merger with Delta." These results align with our own hypothesis because we expect to see positive abnormal returns on the targeted company's stock during the announcement date. Additionally, the researchers found that "The share prices of acquiring and target airlines increased around the merger completion date, suggesting that new information is available as the merge nears completion." This particular study found that both the acquiring and targeted firm showed significant positive abnormal returns in their results. One of the M&A formed were between America West and US Airways, in which the shareholders of America West saw a return of more than 55% on the share price.

In a study on the short-and-long run share performance mergers and acquisitions on the Saudi Arabia Stock Exchange, researchers found that "(1) investors could earn positive market adjusted abnormal returns during the few days surrounding the announcement date: (2) investors could earn positive and significant market-adjusted Buy and Hold

Abnormal Return (BHAR) for shares that are held up to 36 months following the completion months of M&A events" (Zakaria and Kamaludin, 2018). This article gives another perspective on the relationship between the announcement of M&As and the stock market due to the sample of the study using a foreign stock market. Also, the researchers are expecting to see the acquiring company attain positive abnormal returns in contrast to what we expect to see in our study. Their study showed "The short-run abnormal return reflects the expected synergy between the acquirer companies and target companies, consistent with the notion of value creation in the event of M&A" (Zakaria and Kamaludin, 2018). This gives evidence to the notion that the share price of the acquiring company is certainly capable of seeing a positive return during an M&A. This article was an interesting study because it adds to the ongoing debate of whether the targeted company's or the acquiring company's share price results in a positive return during the announcement date of M&A.

Varmaz and Laibner (2016) discuss announced vs. canceled bank mergers and acquisitions from the European banking industry. The article states "The paper finds that European bank M&As have not been successful in terms of shareholder value creation for acquiring banks, whereas targets experienced significant value gains" (Varmaz and Laibner, 2016). This study provides insight to how different sectors of the stock market react to M&As because the sample of it uses banks instead of public trading companies or airlines. Furthermore, it pushes the notion that acquiring companies do not see positive abnormal returns during M&As, while the targeted companies do see positive abnormal returns. However, Mall and Gupta conducted a study on the National Stock Exchange in India and their results were contrary. The sample used in the study consisted of 383 mergers and acquisitions between 2000-2018 and the results state "Findings suggest that consolidation in Indian banking sector leads to positive average abnormal returns and wealth creation for acquirer bank's shareholders" (Mall and Gupta, 2019). The remainder of this paper will contain our sample and methodology in section 2, data and analysis in section 3, our model in section 4, and finally our conclusion.

Event Study

An event study is a statistical method of an empirical investigation of the relationship between security prices and economic events (Dyckman et al. 1984). Most event studies have focused on the behavior of share prices in order to test whether their stochastic Electronic copy available at: https://ssrn.com/abstract=2863243 behavior is affected by the disclosure of firm-specific events. In a corporate context, the usefulness of event studies arises from the fact that the magnitude of abnormal performance at the time of an event provides a measure of the unanticipated impact of this type of event on the wealth of the firms' claimholders (Kothari & Warner 2006)

EMPIRICAL MODEL

Methodology

This study employs a standard event study methodology, using Eventus from WRDS and we fit a standard market model to measure normal performance:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it,} \qquad \text{where } E(\varepsilon_{it}) = 0 \text{ and } \text{var}(\varepsilon_{it}) = \sigma^2_{\varepsilon t} \tag{1}$$

Each sample calendar date is converted to event time by defining the date of the merger announcement date as event date 0. So, for a merger announcement date, event date 0 is the same trading day. The regression coefficients α_i and β_i are estimated in an ordinary least squares (OLS) regression during the estimation period one year (255 trading days) prior to the event period (event days -300 through -46). The event period consists of 61 trading days centered on merger announcement date (-30 through +30). We define four event windows based on the event date, [-30,-2], [-1, 0], [+1, +2] and [+3, +30]. As proxy for the return for the market portfolio R_{mt}, both the CRSP value weighted index and the CRSP equal weighted index are used.

Under standard assumptions, OLS is a consistent estimation procedure for the market model parameters. Under the assumption that asset returns are jointly multivariate normal and independently and identically distributed (iid), OLS is also efficient. The prediction errors, $PE_{i\tau}$, which represent abnormal returns, are simply the OLS residuals, $\hat{\varepsilon}_{it}$.

$$PE_{i\tau} \equiv \hat{\varepsilon}_{i\tau} = R_{i\tau} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt}) \quad (2)$$

with

$$\hat{\sigma}^2_{\varepsilon t} = \frac{1}{255-2} \sum_{\tau=t-299}^{t-46} (R_{i\tau} - \hat{\alpha}_i - \hat{\beta}_i R_{m\tau})^2 \quad (3)$$

The prediction error, PE_{it} is used as an estimator of the abnormal return. In other words, the abnormal return is the residual term of the market model calculated on an out of sample basis. Let $AR_{i\tau}, \tau = t-30, t-29, \ldots t+29, t+30$ be the sample of 61 abnormal returns for firm i in the event window. Under the null hypothesis, conditional on the event window market returns, the abnormal returns will be jointly normally distributed with a zero conditional mean and conditional variance:

$AR_{i\tau} \sim N(0, \sigma^2(AR_{i\tau}))$

The conditional variance $\sigma^2(AR_{i\tau})$ has two components. The first component is the disturbance $\hat{\sigma}^2_{\varepsilon t}$ from (3), and the second component is additional variance due to sampling error in estimating the market model parameters α_i and β_i:

$$\sigma^2(AR_{it}) = \sigma^2_{\varepsilon\tau} + \frac{1}{255}[1 + \frac{(R_{m\tau} - \bar{R}_m)^2}{\hat{\sigma}^2_m}] \text{ where } \bar{R}_m = \frac{1}{255} \sum_{\tau=t-299}^{t-46} R_{m\tau} \quad (4)$$

Since the estimation window is large (255 trading days), I assume that the contribution of the second component to $\sigma^2(AR_{i\tau})$ is zero.

To draw inferences about the average price impact of an event, abnormal return observations have to be aggregated across securities and through time. Average abnormal returns AAR_τ are formed by aggregating abnormal returns $AR_{i\tau}$ for each event period $\tau = t-30, t-29, \ldots t+29, t+30$. Given N events (for our sample, $N = 147$),

$$AAR_\tau = \frac{1}{N} \sum_{i=1}^{N} AR_{i\tau} \quad (5)$$

Under the assumption that average abnormal returns are independent across securities, the asymptotic variance equals to

$$Var(AAR_\tau) = \frac{1}{N^2} \sum_{i=1}^{N} \sigma^2_{\varepsilon\tau} \quad (6)$$

The average abnormal returns are aggregated through time to give the cumulative average abnormal return,

$$CAAR_i(\tau_1, \tau_2) = \sum_{\tau=\tau_1}^{\tau_2} AAR_{i\tau} \quad (7)$$

Setting the covariance terms to be zero,

$$\text{var}(CAAR_i(\tau_1, \tau_2)) = \sum_{i=1}^{N} \text{var}(AAR_{i\tau}) \quad (8)$$

Hence $CAAR_i(\tau_1, \tau_2) \sim N(0, \text{var}(CAAR_i(\tau_1, \tau_2))$

This can be used to test the null hypothesis that the abnormal returns are zero.

The estimated variance of AAR_τ is

$$\hat{\sigma}^2_{AAR} = \frac{\sum_{\tau=t-299}^{t-46} (AAR_\tau - \overline{AAR})^2}{255-2} \text{ where } \overline{AAR} = \frac{\sum_{\tau=t-299}^{t-46} AAR_\tau}{255} \quad (9)$$

The portfolio test statistic for day τ in event time is

$$t = \frac{AAR_\tau}{\hat{\sigma}^2_{AAR}} \quad (10)$$

Assuming time series independence, the test statistic for $CAAR_i(\tau_1, \tau_2)$ is

$$t = \frac{CAAR_i(\tau_1, \tau_2)}{\sqrt{(\tau_2 - \tau_1 + 1)}\hat{\sigma}_{AAR}} \tag{11}$$

The abnormal return estimators often have different variances across firms. A common way of addressing this problem is the standardized residual method (Patell, 1976). Define the *standardized abnormal return*, $SAR_{i\tau}$ as

$$SAR_{i\tau} = \frac{AR_{i\tau}}{\hat{\sigma}_{MLE_{i\tau}}} \tag{12}$$

Where

$$\hat{\sigma}_{MLE_{i\tau}} = \hat{\sigma}^2_{\varepsilon\tau}\left(1 + \frac{1}{T} + \frac{(R_{m\tau} - \bar{R}_m)^2}{\sum_{\tau=t-299}^{t-46}(R_{m\tau} - \bar{R}_m)^2}\right) \tag{13}$$

Is the maximum likelihood estimate of the variance. Under the null hypothesis each $SAR_{i\tau}$ follows a Student's t distribution with T-2 degrees of freedom. Summing the $SAR_{i\tau}$ across the sample yields

$$ASAR_{i\tau} = \sum_{i=1}^{N} SAR_{i\tau} \text{ where } ASAR_{i\tau} \square N(0, Q_\tau) \tag{14}$$

The Z-test statistic for the null hypothesis that $CAAR_i(\tau_1, \tau_2) = 0$ is

$$Z(\tau_1, \tau_2) = \frac{1}{\sqrt{N}}\sum_{i=1}^{N} Z_i(\tau_1, \tau_2) \text{ where } Z_i(\tau_1, \tau_2) = \frac{1}{\sqrt{(\tau_2 - \tau_1 + 1)\frac{T-2}{T-4}}}\sum_{\tau=\tau_1}^{\tau_2} SAR_{i\tau} \tag{15}$$

The two test statistics so far discussed use the variance estimate from the market model during the estimation period to estimate the variance of the abnormal return estimator. But frequently, events increase the variance of returns, so that the event period variance is greater than the estimation period variance. The portfolio test statistic for day t in event time is

$$t = \frac{AAR_\tau}{\hat{\sigma}_{AAR_\tau}/\sqrt{N}} \text{ where } \hat{\sigma}_{AAR_\tau} = \frac{1}{N-1}\sum_{i=1}^{N}(AR_{i\tau} - \frac{1}{N}\sum_{i=1}^{N} AR_{i\tau})^2 \tag{16}$$

We use the above equation to calculate *Adjusted-t*

RESULTS

We ran three different Eventus regression using for sample periods around the announcement date. The first one is the acquirer firms, second one is for the acquired firms and the third one for the combination of acquired and acquirer firms. The results for different days before and after announcement of merger and acquisitions date are shown on Tables 1, 2 and 3.

Table 1 shows the results of acquirer firms. For 30 days, up to 2 days before announcement the Cumulative Abnormal Returns (CAR) is 2.66 percent, one day before the announcement up to the announcement date the cumulative abnormal returns is decline of 1.25 percent, one day up to two days after announcement the cumulative abnormal returns 0.61 percent and finally three days up to thirty days of announcement the cumulative abnormal returns is negative 2.03 percent for the acquirer firms. None of these CAR are not statistically significant for the acquirer companies, which is not surprise since the acquirers pays premium of acquire the smaller firms investors are not willing to pay higher stock price for the acquirer firm. That is in line with the literature in the area of merger and acquisition.

Table 2 show the results of acquired firms. For thirty days up to two days before the announcement the CAR is 8.5 percent, one day before announcement up to the day of announcement the CAR is 11.52%, one days to two days after the announcement day the CAR is 0.42 percent, and from three days up to thirty days after the announcement the CAR is negative 3.72 percent. Except one to two days all the other CAR are statistically significant. These findings are as expected as the literature before the announcement there is significant increase of stock prices in the acquired firms

that is to adjust for the premium the acquirer pay for the merger with the smaller firms. The increase in the stock prices over reaction increases as high as 11.52 percent immediately before and up to the announcement date but will correct/adjusts that over reactions in the coming thirty days after the announcement date up to 3.7 percent. The analysis indicate that the market adjusts to the higher stock prices before and up to the announcement date. There will not be abnormal returns after the announcement date.

Table 3 shows the results of acquiring and acquirer firms together. Thirty days before the announcement days up to two days before the announcement date the CAR is 5.49 percent, one day before the announcement up to the day of announcement the CAR is 4.93 percent, one day after announcement up to two days the CAR is 0.52%, and three days up to thirty days after announcement the CAR is negative 2.82 percent. Only the negative 2.82 percent is statistically significant. Table 3 show that it is better to run separately the acquired and acquirer firms to get the best impact of merger and acquisition on the acquiring and acquired firms.

Table 1. Company A – acquirer
Market Model Abnormal Returns, Equally Weighted Index

Days	N	Mean Cumulative Abnormal Return	Precision Weighted CAAR	Uncorrected Positive: Negative	Patell Z	Patell p-value	Portfolio Time-Series (CDA) t	Portfolio Time-Series p-value	Generalized Sign Z	Generalized p-value
(-30,-2)	16	2.66%	2.22%	8:8	1.370	0.1706	1.626	0.1039	-0.012	0.9906
(-1,0)	16	-1.25%	-0.90%	5:11	-2.127	0.0334	-2.902	0.0037	-1.512	0.1306
(+1,+2)	16	0.61%	0.56%	9:7	1.317	0.1879	1.430	0.1527	0.488	0.6254
(+3,+30)	16	-2.03%	-1.53%	5:11	-0.962	0.3363	-1.262	0.2069	-1.512	0.1306

The symbols (,<,<<,<<< or),>,>>,>>> show the direction and significance of a generic one-tail generalized sign test at the 0.10, 0.05, 0.01 and 0.001 levels, respectively.

Table 2. Company B- Acquired firms
Market Model Abnormal Returns, Equally Weighted Index

Days	N	Mean Cumulative Abnormal Return	Precision Weighted CAAR	Uncorrected Positive: Negative	Patell Z	Patell p-value	Portfolio Time-Series (CDA) t	Portfolio Time-Series p-value	Generalized Sign Z	Generalized p-value
(-30,-2)	15	8.50%	6.38%	12:3>	3.137	0.0017	3.314	0.0009	2.349	0.0188
(-1,0)	15	11.52%	10.28%	11:4	19.275	<.0001	17.107	<.0001	1.833	0.0668
(+1,+2)	14	0.42%	0.22%	8:6	0.398	0.6909	0.626	0.5311	0.559	0.5760
(+3,+30)	14	-3.72%	-3.19%	2:12<<	-1.589	0.1121	-1.475	0.1403	-2.648	0.0081

The symbols (,<,<<,<<< or),>,>>,>>> show the direction and significance of a generic one-tail generalized sign test at the 0.10, 0.05, 0.01 and 0.001 levels, respectively.

Table 3. Both Acquirer and Acquired firms
Market Model Abnormal Returns, Equally Weighted Index

Days	N	Mean Cumulative Abnormal Return	Precision Weighted CAAR	Uncorrected Positive: Negative	Patell Z	p-value	Portfolio Time-Series (CDA) t	p-value	Generalized Sign Z	p-value
(-30,-2)	31	5.49%	4.03%	20:11	3.167	0.0015	3.590	0.0003	1.626	0.1040
(-1,0)	31	4.93%	3.97%	16:15	11.879	<.0001	12.289	<.0001	0.189	0.8502
(+1,+2)	30	0.52%	0.42%	17:13	1.233	0.2175	1.307	0.1913	0.739	0.4596
(+3,+30)	30	-2.82%	-2.23%	7:23<<	-1.788	0.0738	-1.875	0.0607	-2.912	0.0036

The symbols (,<,<<,<<< or),>,>>,>>> show the direction and significance of a generic one-tail generalized sign test at the 0.10, 0.05, 0.01 and 0.001 levels, respectively

CONCLUSION

In this paper we revisited Merger and Acquisition (M&A) of companies that are traded in the US stock exchanges. The original samples were 53 pair of firms that M&A were from 2011 until 2019. The methodology used is event study using Eventus and data accessed from Wharton Research Data System (WRDS). The final sample that we were able to get the data are 33 pair of firms. Our aim is to if either the acquirer or acquired firms earned Cumulative Excess Returns (CAR) around the announcement date of the M&A. We observed 30 days before and 30 days after the announcement days. Our results of acquired firms show positive and significant CAR before the announcement date. For thirty days up to two days before the announcement the CAR is 8.5 percent, one day before announcement up to the day of announcement the CAR is 11.52%. Meanwhile after the announcement date (+3, +30) there were statistically significant correction (i.e. negative 3.72 percent CAR) for the acquired firms. These findings are as expected as the literature before the announcement there is significant increase of stock prices in the acquired firms that is to adjust for the premium the acquirer pay for the merger with the smaller firms. The increase in the stock prices over reaction increases as high as 11.52 percent immediately before and up to the announcement date but will correct/adjusts that over reactions in the coming thirty days after the announcement date up to 3.7 percent. Indicating even after the corrections investors earn large CAR from the investment in acquired firms.

Acquiring firms did not earn any significant negative or positive cumulative abnormal returns around the announcement date. Acquiring firms usually pay premium to take over the target company which explains why investors are not willing to pay higher prices at least in the short term. But the long-term effect on acquiring firms could be outside of the scope of this paper would be of interest for future research. However, acquiring firms are paying premium either to increase market share or diversification advantages which will have positive impact in the long run. Furthermore, the impact of COVID-19 on M&A would be of interest for future research.

REFERENCES

Desjardins, J. (2019). The $86 trillion world economy - in one chart. *World Economic Forum* https://www.weforum.org/agenda/2019/09/fifteen-countries-represent-three-quarters-total-gdp/#:~:text=The%20%2486%20Trillion%20World%20Economy%20in%20One%20Chart&text=And%20as%20consumer%20preferences%2C%20technology,the%20world's%20%2486%20trillion%20economy. Accessed July 18, 2020.

Dontis-Charitos, P., Molyneux, P., & Staikouras, S. K. (2011). Does the stock market compensate banks for diversifying into the insurance business? *Financial Markets, Institutions & Instruments*, *20*(1), 1-28.

Mall, P., & Gupta, K. (2019). Impact of merger and acquisition announcements on stock returns and intraday volatility: Evidence from Indian Banking sector. *Journal of Entrepreneurship and Management*, *8*(3), 1-11.

Mall, P., & Gupta, K. (2020). Impact of merger and acquisition announcements on stock return, volatility and liquidity of acquirers: Evidence from the Indian bank sector. *Management & Accounting Review*, *19*(1), 73-101.

Manuel, Jr., C.S., & Rhoades, D.L. (2014). Merger activity and short-run financial performance. *Transportation Journal*, *53*(3), 345-375.

Palmer, B. (2019). *Investopdia* https://www.investopedia.com/ask/answers/why-do-companies-merge-or-acquire-other companies/#:~:text=Mergers%20and%20acquisitions%20(M%26As)%20are,share%2C%20or%20influencing%20supply%20chains. Accessed July 18, 2020.

Patell, J. (1976). Corporate forecasts of earnings per share and stock price behavior: Empirical Tests, *Journal of Accounting Research*, *14*, 246-274.

Szmigiera, M. (2020). Value of M&A transactions globally 1985-2019. *Statistica*https://www.statista.com/statistics/267369/volume-of-mergers-and-acquisitions-worldwide/#:~:text=In%202019%2C%20the%20value%20of,to%203.7%20trillion%20U.S.%20dollars.&text=Mergers%20and%20acquisitions%20(M%26A)%20is,enterprise%20in%20its%20particular%20sector. Accessed July 18, 2020.

Varmaz, A., & Laibner, J. (2016). Announced versus canceled bank mergers and acquisitions: Evidence from the European banking industry. *Journal of Risk Finance*, *17*(5), 510-544.

Zakaria, N., & Kamaludin, K. (2018). The short-and-long run performance of mergers and acquisitions: Evidence from Tadawul. *Academy of Accounting and Financial Studies Journal*, *22*(6), 1-16.

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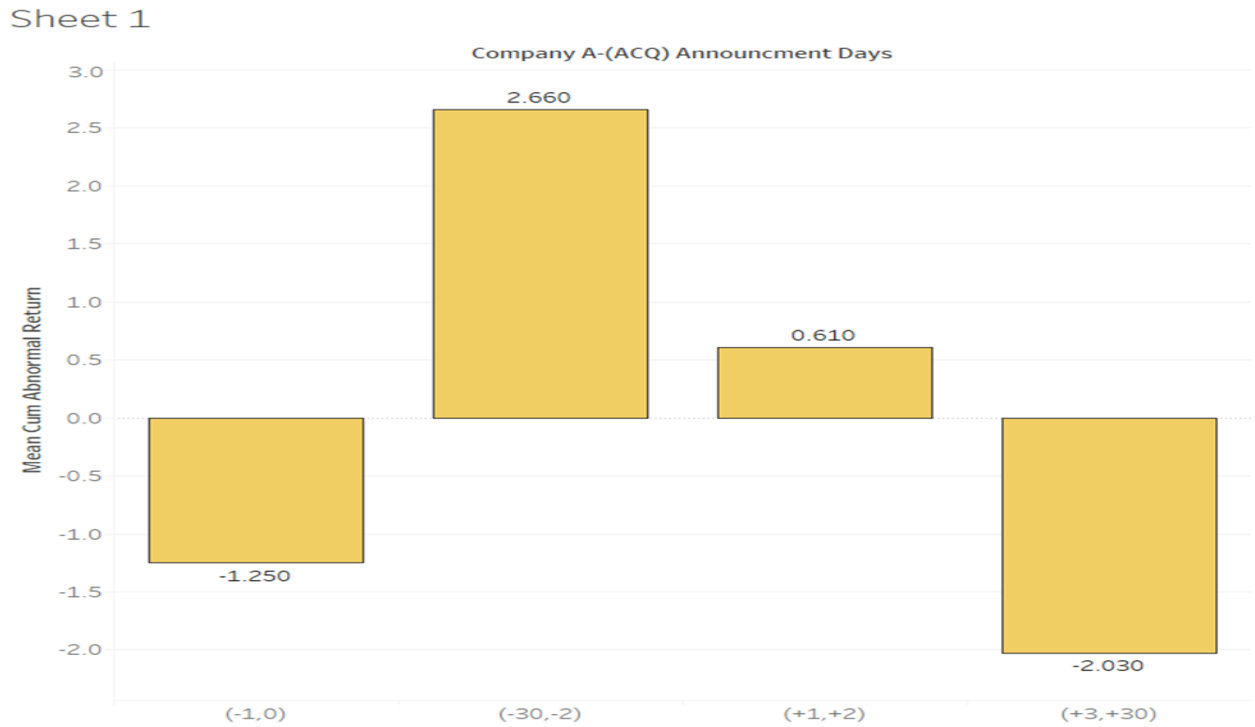
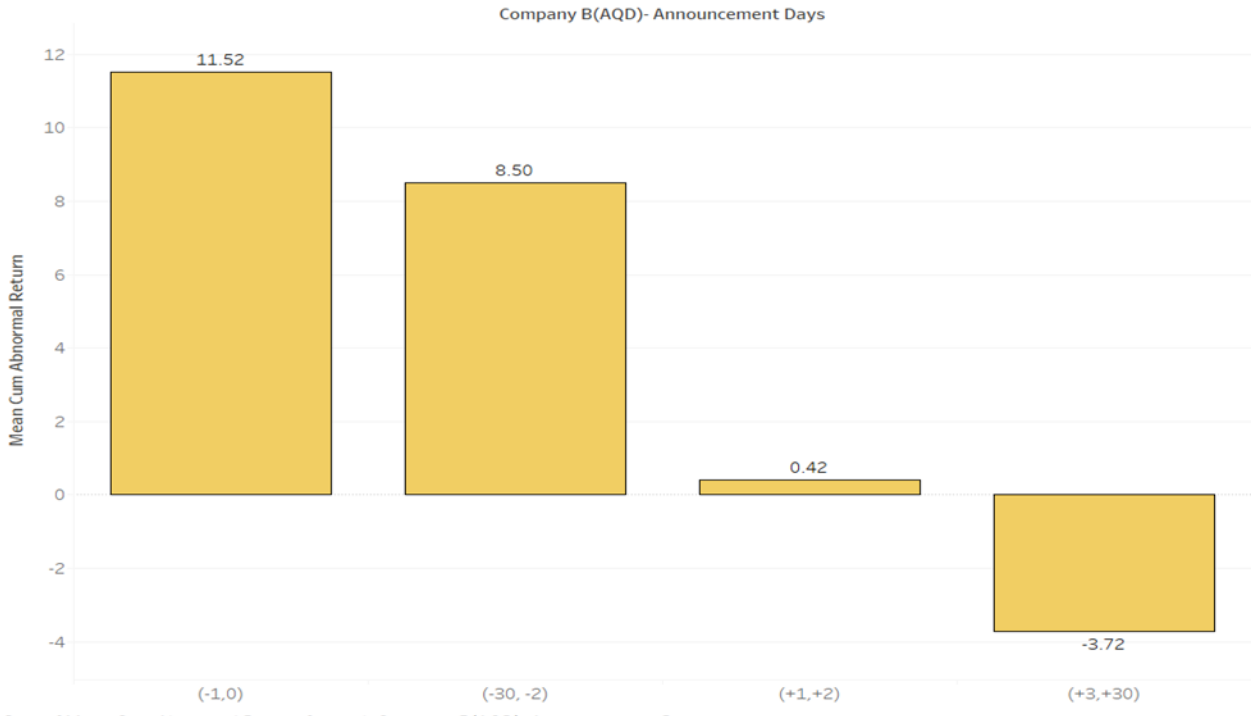
APPENDIX

Figure 1



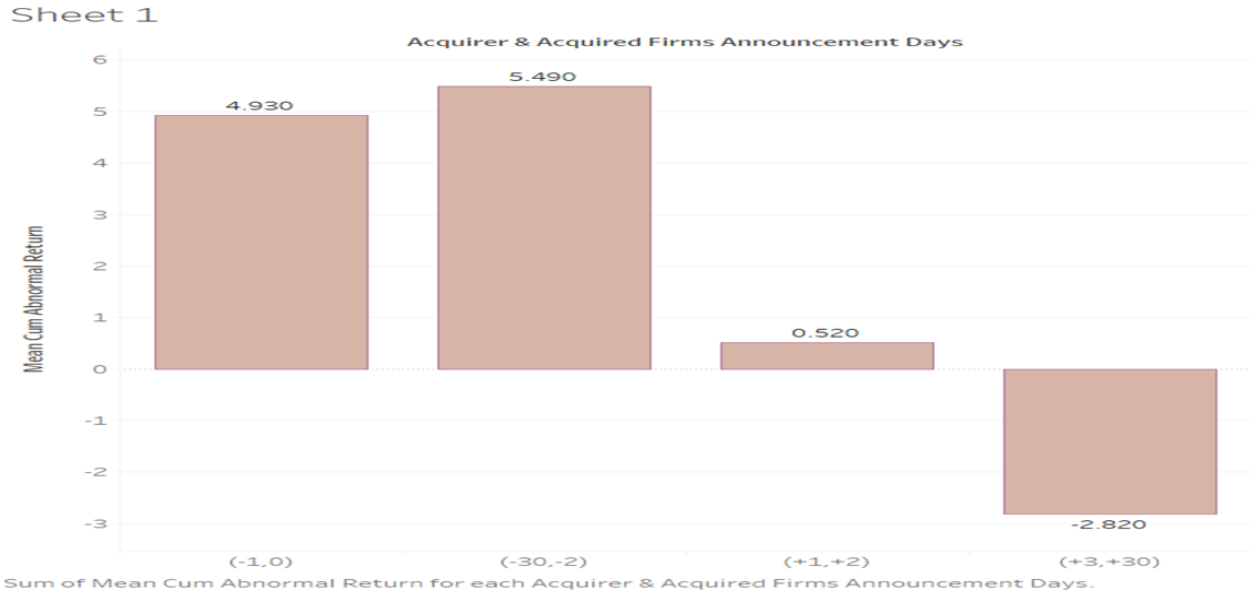
Sum of Mean Cum Abnormal Return for each Company A-(ACQ) Announcment Days.

Figure 2



Sum of Mean Cum Abnormal Return for each Company B(AQD)- Announcement Days.

Figure 3.


Sheet 1
Acquirer & Acquired Firms Announcement Days
Mean Cum Abnormal Return
6
5
4
3
2
1
0
-1
-2
-3
4.930
5.490
0.520
-2.820
(-1,0)
(-30,-2)
(+1,+2)
(+3,+30)
Sum of Mean Cum Abnormal Return for each Acquirer & Acquired Firms Announcement Days.

TRANSITION TO ONLINE LEARNING: BUSINESS STUDENT PERSPECTIVES DURING THE CORONAVIRUS PANDEMIC

April Bailey, University of South Florida

ABSTRACT

This paper reports the experiences of business students at a public four-year institution through the transition to online instruction during the coronavirus pandemic. Specifically, this paper explores results of transitioning a face-to-face classroom to an online learning modality to finish the spring 2020 semester. Results from this study are important not only to the colleges of business but also to the other colleges, as interest in university communication and instructional delivery has universally changed in order to better serve students' needs. In this study, 75.8% of the students surveyed agreed or somewhat agreed that the university had communicated well with them about changes to their education due to the coronavirus. However, the levels of stress reported correlated with their degree of preference for instruction modality: students with a stronger preference for in-person instruction are more likely to agree that they are stressed out. The correlation between a student's confidence in online learning (that they can do well) and the stress of taking online courses is statistically significant. Additionally, male students expressed more confidence in studying online than female students. Senior-level students reported being less stressed out and had more confidence in online learning.

INTRODUCTION

Transitioning to online learning in this unprecedented time in our country and in higher education has had its many challenges. In the spring of 2020, the rapid onset of the pandemic left many educators across the country and world needing to transition a course that had never been taught other than face-to-face to an online modality in a matter of days. Administrators were faced with the challenge of writing effective communications to students to explain the changes the pandemic was going to have on the remainder of their semesters. The author of this paper wanted to determine how well a university transitioned a student body to an online format in a short period. Data was gathered from 165 undergraduate students in a required business course, "Business Workplace Skills and Best Practices." The aim was to assess student attitudes towards the mandated shift from face-to-face instruction to online learning due to the pandemic. The data sheds light on business students' perceptions on the shift from face-to-face class to online learning. This paper reports student preferences about online learning compared to face-to-face instruction, stresses related to the shift to online education, and student beliefs about whether the university had adequately communicated with them.

LITERATURE REVIEW

Distance education is a way for students to maintain their daily schedules, while having the flexibility of completing their required coursework. Several studies document the increasing enrollments of adult students in universities (Chao & Good, 2004; Graham, Donaldson, Kasworm, & Dirkx, 2000; O'Donnell & Tobbell, 2007). Adult students make up more than 40% of the total U.S. undergraduate population (U.S. Bureau of the Census, 2005). In the past 35 years, the college population over the age of 25 has increased. From 1970 to 1991, the number of adult students enrolled in higher education increased by 171.4% (Kasworm et al., 2002). The enrollment of adult students is attributed to our global economy, cultural and ethnic diversity, immigration, competitive job market and its demands for new skills and technology, professional development, more women in the workforce (changing norms and roles), higher professional standards and certifications, and second career retirees (Compton, Cox, & Laanan, 2006; Merriam et al., 2007). Due to the increase of adult students, colleges and universities need to consider redesigning programs and services to meet the needs of these students. An underlying assumption from the literature is that colleges and universities cannot continue with business-as-usual (Apps, 1981, p. 11). Because of these shifting demographics, many universities and colleges over the last decade have been expanding their course offerings to include online modalities in order to better serve the student population. However, some students still prefer the traditional face-to-face instruction and have anxiety associated with online learning. In "Anxiety and Performance in

Online Learning," Saadè et al. (2017) found that 30% of students experienced anxiety as it relates to online learning. Numerous studies and articles identify student anxiety as it relates to their performance within the higher education system (Bisson 2017; Bolliger 2011; June 2020; Saadè, Nebebe, & Kira 2015; Shibli et.al. 2012; Vitasari & Wahab 2010; Woldeab & Brothen 2019). The stresses from the sudden shift go beyond student learning preferences to worries such as adequate connectivity, access to electronic equipment and the Internet when the university's library is suddenly closed.

In June's article (2020) of The Healthy Minds Network/American College of Health Association, 18,000 college students were asked about their coronavirus stress-related stress; the survey found that administrators and faculty members received high scores for the support they provided: "Sixty-nine percent of students report that their campus administration has been supportive during the pandemic, and 78% perceived their professors as being supportive."

Much of the stress students felt moving from face-to-face instruction to online learning may have been caused by the abrupt transition to emergency online teaching: students did not know how long the change would be in effect, and the complexity of life issues the student faced included faculty utilizing a videoconferencing platform, Zoom, in order to avoid course content disruption and meet CDC guidelines of social distancing. In an April 2, 2020 interview, Professor Adriano Udani mentioned students feeling "zoomed out," a reference to being on back-to-back videoconferencing, perhaps for work during the day, and attending at night for graduate school, or having back-to-back classes for undergraduates. Students who thought they were taking a face-to-face course were required to switch to learning virtually along with shifting schedules for work, childcare, pet care, and difficulty with internet bandwidth, health concerns, finances, and stay-at-home recommendations.

The National Research Center for Distance Education and Technological Advances suggests that using only Zoom "may not be the best way to teach online." (Supiano 2020). While Zoom does provide the visual cues and options for synchronous participation and class discussions, it is limited by student engagement (i.e. if students turn of microphones and video) and ultimately the experience is impacted if there is not adequate internet connectivity. And use of programs like Zoom to meet remotely assumes that faculty are technologically capable of using such programs to replace in-class activities.

Regardless of the pandemic context, students need visual cues, experience with college classes and practice with tools like Blackboard and Canvas under any circumstances to increase their chances of being successful in college. Danesh, Bailey, and Whisenand (2015) found that students respond well to visual cues which furthered the class discussions (synchronous delivery) versus having content simply posted to a course management tool platform (asynchronous delivery). Additionally, they reported that 64% of the students agreed that the professor's knowledge and use of technology during the synchronous sessions was critical to the overall success of the class. But instructors had little time to transition during the pandemic and little time to learn the technology themselves. This only added to the students' obvious stressors of internet connectivity (bandwidth issues), sharing computer equipment with family members, and finding a quiet place to focus on their studies.

Also playing an important role in students transitioning to online learning is the learner interface (for example: Blackboard or Canvas). Students that have had proper training and experience with the interface/platform will feel more comfortable enrolling in a hybrid course or online course. Findings by Danesh, Bailey, and Whisenand (2015) match the results found in this 2020 study, indicating that seniors were more comfortable with online learning.

Many students have computer phobias; especially for those students, online classes which award points for attendance and participation could cause concern; taking exams online can be stressful for students without reliable internet access. As Saadè and Kira (2009) note, "A number of studies have provided evidence supporting a direct relationship between computer anxiety and computer use." Ultimately, means that computer-shy students who are required to use computers to complete tasks in a course, their anxiety increase in direct relationship to the amount they are required to do online putting them at a disadvantage compared to other students.

Gender and age may also play a role in self-efficacy of online learning. Self-efficacy is defined as an individual's belief that they have the capability of executing behaviors needed to perform. Within the literature, women are often reported to be less comfortable with or confident about online learning and the use of learning management systems; this lack of confidence may be related to a student's sense of self-efficacy (Saadè & Kira, 2009). Saadè et al. (2017) found that of the total study population, of those expressing anxiety, females outnumbered males 7 to 1 by reporting they felt some sort of anxiety with online courses. Kramarae (2001) writes in Third Shift: Women Learning Online that there are a variety of barriers and reasons that female students have a harder time with online learning. She names life-work balance, job responsibilities, community roles, and financial burdens, on top of academic coursework. Nineteen years later, the gender divide on computer literacy is still prevalent in higher education classrooms and often can be related to student efficacy. Where there were differences within the literature, Saadè et al.'s (2017) work found that older students (21-22) reported higher levels of anxiety than a slightly younger age group (17-18).

METHODOLOGY

This study used a survey methodology. Data was gathered from 165 undergraduate students at a preeminent research university in a required business course, "GEB 3033: Business Workplace Skills and Best Practices." Students enrolled in the course were asked to complete the 32-question survey in Qualtrics, an online survey platform after the course transitioned from a face-to-face mode to an online mode because of the coronavirus. One hundred and sixty-five (165) declared business students completed the survey, which included demographic information, confidence and stress levels of online learning, and accounts of students' experiences as they transitioned to online learning to finish the semester.

ANALYSIS AND DISCUSSION OF RESULTS

The survey data of 165 respondents were analyzed using SPSS. A larger majority (60.6%) of the participants were male; 38.8% were female; and one student (0.6%) chose not to gender-identify. First-year students (3.6%), sophomores (19.4%), juniors (54.5%), and seniors (22.4%) made up the class rank. The students' ages ranged from 18 to 44, with 49.1% of the respondents indicating they were 20 years of age or younger. In terms of study behavior, students indicated they studied and used their computer most often at home (97%) followed by school (30.3%), work (13.3%), café (7.3%), and other (6.1%). Students were asked how the Coronavirus had impacted them. Emotional stress was the most mentioned at 69.1% followed by travel plans (65.5%), financially (58.2%), family (50.9%) and other (9.1%).

Students were given a Likert-scale of agree, somewhat agree, neither agree nor disagree, somewhat disagree, and disagree. Figure 1 shows 75.8% of students somewhat agreed or agreed that the school had communicated well with them about changes to their education due to the coronavirus.

Figure 1: University Communication

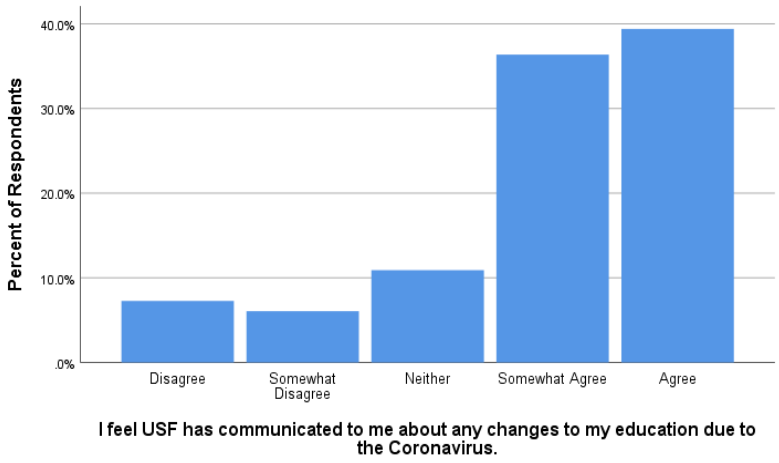
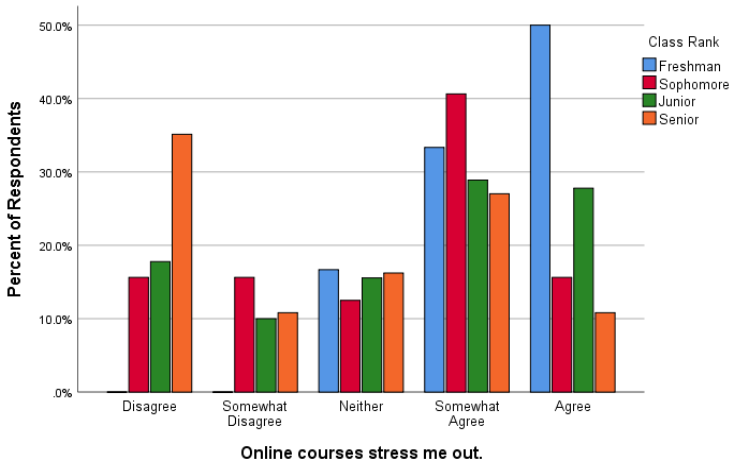


Figure 2 shows student responses based on their class rank. It would be expected that freshmen would most likely have more stress related to online learning since they are new to college and are learning the university's online course management tool. It might be quite different than the one a student was familiar with in high school. By the time students are at a senior level, they have had more experience with the online platform and are likely to be comfortable adjusting to a change in online learning.

To better understand student preference for online versus face-to-face learning, a chi-square test shows that students who express a stronger preference for in-person instruction are more likely to agree they are stressed out (P- value =0.00). The chi-square test shows that students who express stronger preferences for online learning are less likely to agree they are stressed out (P-value =0.00). It is important to note that preferring to do something one way doesn't always indicate the lack of ability or confidence in doing it a difference way. The correlation between confidence in online learning and the stress of taking online courses are -0.60. It is statistically significant at α =0.01. The correlation between preference for online learning and the stress of taking online courses is -0.52. It is statistically

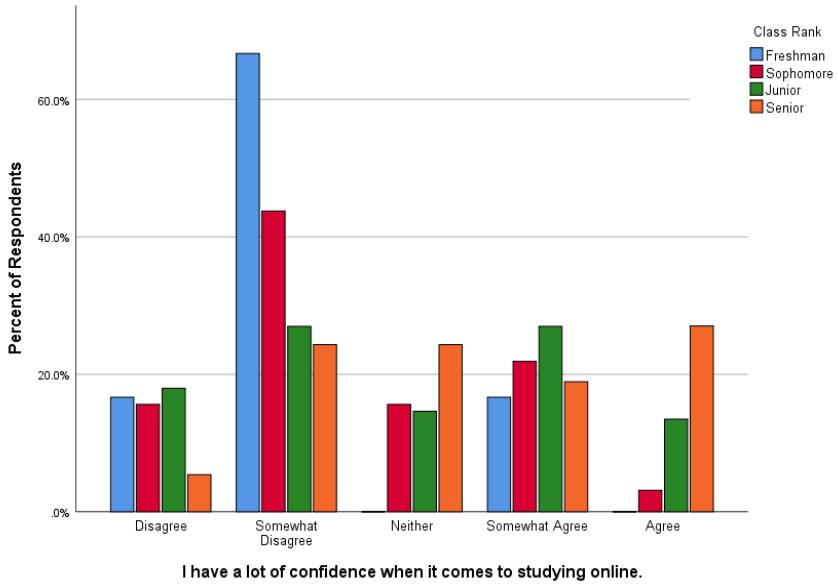
significant at α =0.01. The correlation between preference in face-to-face instruction and the stress of taking online courses is 0.54. It is statistically significant at α =0.01. Understanding differences between genders, an Independent Samples T-Test showed that there is no significant difference between male and female students in their opinions for the statement, "Online courses stress me out" (P value = 0.11).

Figure 2: Online Course Stress by Class Rank



Students in the GEB 3033 Business Workplace Skills and Practices course were developing skills in the areas of communication, negotiations, organizational and time management, teamwork, collaborations, leadership, and critical thinking. Students were graded on written assignments, quizzes, class attendance, discussion boards, and a final exam. When students were asked about their confidence level of learning online,14.5% disagreed that they have confidence in studying online, 30.9% somewhat disagreed, 16.4% neutral, 23.6% somewhat agreed, 13.9% agreed, and 0.6% did not respond. An Independent Samples T-Test shows that male students expressed more confidence in studying for online courses than female students (P value=0.045).

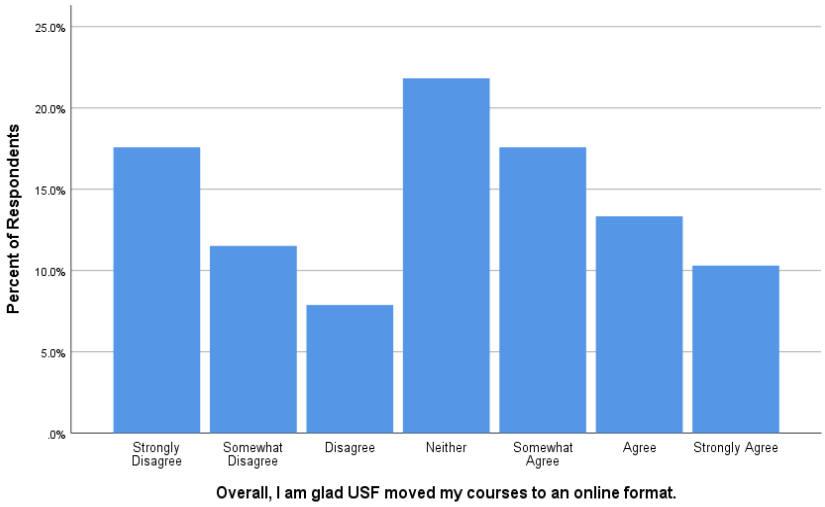
Figure 3: Student Confidence in Online Learning



Despite the educational modality transitions and Internet connectivity uncertainties for students, most students indicated that they were glad that the course moved to an online format from a face-to-face format so that they could complete the semester. Students agreed or somewhat agreed (68.4%) that this would be a good course to offer in future semesters as an online course option. An Independent Samples T-Test showed that female students felt more

strongly than male students that this would be a good course to offer in future semesters as an online course option (P value=0.00). A one-way ANOVA test showed that seniors feel more strongly than students of lower-class rank that changing the course to an online format was a good decision by college administration. Additionally, the one-way ANOVA showed that seniors felt more strongly than students of lower-class rank that changing the course to the online format due to COVID-19 lowered their stress level. Finally, the one-way ANOVA showed that seniors are less stressed out and had more confidence about online courses than freshman, sophomores, and juniors.

Figure 4: Glad Course Moved to Online Format



Another interesting finding looked at whether the student's stress level would change for the better when the course rapidly transitioned to online format so the students could finish their coursework. A chi-square test revealed that the answer depended on the student's perceived stress level about online learning (p-value = 0.09). Students who felt stressed about online courses in general felt that changing the learning format to online due to COVID-19 had not lowered their stress level. The chi-square test also showed that giving the students that option to change their letter grade to a pass/fail grade was significantly related to the perceived stress level toward online courses (p-value =0.02). Surprisingly, students who reported being stress about online learning did not think the option to change to a pass/fail grade helped their stress level.

A one-way ANOVA test suggested that students who had taken more online courses prior to COVID-19 tended to disagree or somewhat disagree that online courses stressed them out (p-value = 0.008). An additional one-way ANOVA test also indicated that the total number of online courses taken prior to COVID-19 positively affected the confidence in online learning (p-value = 0.016).

When students were asked "How stressed were you with transitioning this class to an online format midway through the semester?" using 0 as not stressed at all, 100 as extremely stressed, the mean stress level was 52 with a standard deviation of 31.

CONCLUSIONS

Anxiety in online learning is not an issue that will go away anytime soon. There is a likelihood that online learning is here to stay, and more institutions will have to take learning and training to an online format even once the coronavirus passes. Therefore, students' anxieties in online learning clearly needs to be addressed, perhaps through having first year and transfer students complete some sort of training with the online course management tool used by the institution.

Assuming that online classes will frequently be our reality, educators may want to account for these online computer anxieties and there may need to be several steps or approaches to aid in solving the problem. There are many ways to make online learning more attractive to students; course designers and instructors can re-think conventional course contents and design to better address students' needs in shifting to online classes.

As instructors we may need to look at meeting our course learning objectives to determine if synchronous or asynchronous would be better for students when being required to teach online. Synchronous online teaching is not without challenges. The difficulty with an instructor having 40 students on a single synchronous call is student boredom, students not paying attention, and students hesitating to speak up. Perhaps an exam could be more of a project-based deliverable and instead of having 40 or more students on a call there could be small group-based peer learning to offer more chance for each student to contribute but also participate and be engaged. Using innovative teaching strategies such as "flipping the classroom" could be helpful to students. A way to transition students to online learning in a blended, student-centered approach is "flipping the classroom." Wang et al. (2019) found that "flipping the classroom" was successful if there was strong instructor presence and availability.

A broad range of experimental learning opportunities such as guest lectures, virtual tours, virtual study groups are some of the ways to be inclusive of student needs for learning (such as learning styles and honoring their life experience) all while keeping it safe by social distancing.

FUTURE RESEARCH

There are vast opportunities to build on this study. This study could be replicated to other universities and colleges to include a larger group of respondents based on the primary findings of the study in order to validate students' experiences as they transition to online learning during the Coronavirus pandemic. Additionally, there is an opportunity for the study to expand the study beyond business students. More research could look at how computer anxiety impacts the final letter grade of a student that perceives themselves to have computer usage induced stress. Determining the underlying causes of the anxiety will help administrators, faculty, and staff better prepared to help students. Lastly, more research needs to be completed on the gender issues and racial issues related to the digital divide. How can instructions better assist female students that are taking online courses so that they feel more confident? Truly, it may take years to learn of the impacts the coronavirus has had on student retention rates and completion of their educational goals.

REFERENCES

Apps, J. W. (1981). *The adult learner on campus: A guide for instructors and administrators.* Chicago: Follett.

Bisson, K. (2017, Spring). The effect of anxiety and depression on college students' academic performance: Exploring social support as a moderator. Retrieved July 01, 2020, from https://digitalcommons.acu.edu/etd/51/

Bolliger, D. (2011, November 30). Student perceptions of satisfaction and anxiety in an online doctoral program. Retrieved July 01, 2020, from https://eric.ed.gov/?id=EJ965546

Chao, R., & Good, G. E. (2004). Nontraditional students' perspectives on college education. *Journal of College Counseling, 7*(1), 5-12.

Compton, J. I., Cox, E., & Laanan, F. S. (2006). Adult learners in transition. *New Directions for Student Services, 114*, 73-80.

Danesh, A., & Bailey, A. E., & Whisenand, T. (2015). Technology and instructor-interface interaction in distance education. *International Journal of Business and Social Science*, *6*(2).

Graham, S. W., Donaldson, J. F., Kasworm, C., & Dirkx, J. (2000). The experiences of adult undergraduate students - what shapes their learning? (Report No. CE080040). New Orleans, LA: American Educational Research Association National Conference. (ERIC Document Reproduction Service No. ED440275)

June, A. W. (2020, July 13). College students have been stressed out during the pandemic. Here's how it's affected their mental health. *The Chronicle of Higher Education.* Retrieved July 23, 2020 from https://www.chronicle.com/article/College-Students-Have-Been/249167?key=O01RVfHGcmvIBQW9wWAeoLmEQtJgUTbof_k8-cCTpBy2sJHaLi3IqXzAAIfIRtKXQlFaVlg4YzVDeDVSUGhMNEJUR3d5UWM0Qm9IeTBLNHEzTldtZV9jbzRHYw

Kasworm, C. E., Polson, C. J., & Fishback, S. J. (2002). *Responding to adult learners in higher education*. Malabar, FL: Krieger.

Kramarae, C. (2001). The third shift: Women learning online. American Association of University Women Educational Foundation. Retrieved from https://eric.ed.gov/?id=ED461348

Merriam, S. B., Caffarella, R. S., & Baumgartner, L. M. (2007). *Learning in adulthood: A comprehensive guide* (3rd ed.). San Francisco: Jossey-Bass.

O'Donnell, V. L., & Tobbell, J. (2007). The transition of adult students to higher education: Legitimate peripheral participation in a community of practice? *Adult Education Quarterly, 57*(4), 312-328.

Saadè, R. G., Nebebe, F., & Kira, D. (2017, January). Anxiety & performance in online learning. Retrieved July 01, 2020, from https://www.researchgate.net/publication/320656547_Anxiety_Performance_in_Online_Learning?enrichId=rgreq-e1df4bc02f6e5dcf6b73f1c8c8f62908-XXX

Saadè, R., & Kira, D. (2009). Computer anxiety in e-learning: The effect of computer self-efficacy. Retrieved July 01, 2020, from https://www.informingscience.org/Publications/3386

Saadé, R., Nebebe, F., & Kira, D. (2015, June 07). Characterising computer experience and anxieties differences between Middle Eastern and Western students in eLearning. Retrieved July 01, 2020, from https://www.informingscience.org/Publications/2225?Type=MostDownloadedNenad

Shibli, D., Nawaz, N., Ameen, N., Fatima, S., & Khan, H. (2012, April). [PDF] The effects of anxiety on achievement and performance: A college study. *Semantic Scholar*. Retrieved July 01, 2020, from https://www.semanticscholar.org/paper/The-Effects-of-Anxiety-on-Achievement-and-:-A-Study-Shibli-Nawaz/bfd47c8395562e621fc905b8641e7764f5d3fa09

Supiano, B. (2020, April 02). Zoomed out: Why live teaching isn't always the best. Retrieved July 01, 2020, from https://www.chronicle.com/article/Zoomed-Out-Why/248401

The Health Minds Network/American College Health Association. (2020). The impact of Covid-19 on student well-being. http://www.Healthy_Minds_NCHA_COVID_Survey_Report_Final(6).pdf

U.S. Bureau of the Census. (2005). National population estimates by characteristics. http://www.census.gov/popest/national/asrh/NC-EST2004-sa.html. Accessed November 15, 2007.

Vitasari, P., & Wahab, M. A. (2010, June). The use of study anxiety intervention in reducing anxiety to improve academic performance among university students. Retrieved July 01, 2020, from ://www.researchgate.net/publication/43968967_The_use_of_Study_Anxiety_Intervention_in_Reducing_Anxiety_to_Improve_Academic_Performance_among_University_Students

Wang, Y., Huang, X., Schunn, C.D. *et al.* Redesigning flipped classrooms: a learning model and its effects on student perceptions. *Higher Education: The International Journal of Higher Education Research 78***,** 711–728 (2019). https://doi.org/10.1007/s10734-019-00366-8

Woldeab, D., & Brothen, T. (2019). 21st Century assessment: Online proctoring, test anxiety, and student performance. Retrieved July 01, 2020, from http://www.ijede.ca/index.php/jde/article/view/1106

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COMPARISON OF HEALTH CARE POWER OF ATTORNEY APPROACHES

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ABSTRACT

The health care power of attorney approach affords a competent adult the ability to plan for future health care decisions. If the person is no longer capable of making decisions, the power of attorney authorizes the agent to make health care decisions on behalf of the principal. The power of attorney for health care may also include individual health care instructions. The enforcement of fundamental obligations between the physician and the agent will need to be considered in light of state health care power of attorney statutes. To provide health care services under the direction of the power of attorney, the healthcare professional is still required to comply with standards of appropriate practice. If the patient losses decision making capacity and is no longer able to participate actively, the health care power of attorney becomes effective and the agent assumes responsibility for making decisions for the care of the patient. The healthcare professional is required to follow statutory provisions prior to prescribing treatment for the patient. The interpretation of the statutory provisions by physicians, health care facilities, insurers and family may present uncertainty because of a multitude of scenarios, including treatment options, safeguards, prognosis, medical judgment, and impairment of dignity. Prior research to examine the variances in the provisions associated with health care power of attorney legislation within the United States has been limited. To address this gap in the literature, this paper will examine health care power of attorney legislative trends including the appointment, eligibility, access to health information, disclosure requirements, medical limitations, range of life-sustaining interventions and authority of agents.

COMPARISON OF HEALTH CARE POWER OF ATTORNEY APPROACHES

This paper presents a literature review and critique of a specific aspects of health care power of attorney legislation to understand the emerging health care trends. The Medicare Patients' Rights under the Condition of Participation for hospitals addresses the patient's right to make informed decisions regarding their treatment and services (42 CFR 482.13 (b) (2)). According to the CMS guidance manual for Medicare and Medicaid surveyors of long-term care facilities, the facility is required to maintain written policies and procedures to implement advance directives and applicable State laws (42 CFR 483.10(b) (8)). In addition to federal regulations, state laws also address the rights of patients to designate another person to make health care decisions. States have promulgated durable power of attorney protocol measures as a tool to protect patients. However, the applicable state laws lack uniformity in stipulating the assignment of the responsibilities by the patient to a designated power of attorney. This study evaluates the various state statutes and summarizes the similarities and differences of the durable power of attorney laws that have been adopted by the states. This paper attempts to examine important aspects of current state legislation that enables the patient granting the power to designate an agent in a health care power of attorney to make health care decisions for the individual. In addition, the paper investigates further provisions to expand safeguards for the standard durable power of attorney model.

JUDICIAL INTERPRETATION OF THE HEALTH CARE POWER OF ATTORNEY

In order to review the doctrine of the health care power of attorney, this paper reviews the relevant regulatory provisions in various jurisdictions. The significance of the health care power of attorney doctrine differs among the jurisdictions, however for purposes of this investigation the paper will specifically address the function and scope of the health care power of attorney. The Superior Court of Pennsylvania has consistently upheld the statutory doctrine of the durable power of attorney. When a patient has executed a durable power of attorney (DPA) and named a personal representative, the patient's choice is given paramount importance in legal proceedings. In Re Sylvester, 409 Pa. Super. 439 (1991); In Re Duran, 2001 Pa. Super. 52 (2001).

Medicare Act Requirements

Under Title XVIII of the Social Security Act, the Medicare Act establishes a federally subsidized health insurance program for the elderly and disabled (42 USC 1395). The Centers for Medicare and Medicaid Services (CMS), a component of the Department of Health and Human Services, administers the Medicare program (42 USC 1395). The Medicare Patients' Rights under the Condition of Participation for hospitals addresses the patient's right to make informed decisions regarding their treatment and services (42 CFR 482.13 (b) (2)). The Interpretive Guidelines

provide for a patient to delegate their right to make informed decisions to another person. If the patient is unable to decide, the Interpretive Guidelines stipulate that the hospital must consult the patient's advance directives, medical power of attorney or patient representative. According to the guidelines, the hospital is expected to provide relevant information to the representative so that informed health care decisions can be made for the patient.

According to the CMS guidance manual for Medicare and Medicaid surveyors of long-term care facilities, the agency instructions require the facility policies to establish a protocol to determine whether the resident has executed a directive or instructions indicating their desired care. The decision-making responsibilities may be expressed in documentation including the durable power of attorney for health care or a medical power of attorney. According to the federal law, the facility is required to maintain written policies and procedures to implement advance directives and applicable State laws (42 CFR 483.10(b) (8)).

American Medical Association Guidance

The American Medical Association encourages its members and families to use the Advance Directives and Health Care Powers of Attorney. The AMA Ethics Policy H-140.845 advocates for health care providers to discuss with and educate the public about the need to establish advance directives and appoint health care proxies. In addition, the policy encourages medical schools to educate medical students and residents on the importance of the Durable Power of Attorney and Advance Directives.

FEATURES OF DURABLE POWER OF ATTORNEY PROCESS LEGISLATION

Numerous durable power of attorney for health care or medical power of attorney laws have been enacted by states to provide statutory standards to regulate the manner for competent adults to control their health care by the designation of health care agents. The absence of a written durable power of attorney may cause serious negative patient outcomes. Therefore, several states have intervened to regulate the implementation of these practices. The durable power of attorney statutes have many similarities and unique specific provisions. In this paper, the statutory differences of a random sample of durable power of attorney laws are documented for comparative analysis.

Principle of Patient Autonomy

The Pennsylvania statute upholds the principle that individuals have a qualified right to make decisions relating to their own health care (20 Pa. C.S.A. 5423 c (1)). According to the Maryland statute, a competent individual may make an oral advance directive or appoint an agent to make health care decisions for the individual which has the same effect as a written document (Md. Health Code Ann. 5-602). The Wyoming Statute (W.S. 35-22-412) recognizes the right of an individual to make health care decisions while having capacity to do so.

Definition of Durable Power of Attorney

Under the provisions of the Massachusetts statute (Mass. Ann. Laws 5-501), a durable power of attorney is an express writing by a principal designating another to serve as their agent in the event of a disability or incapacity of the principal. In Pennsylvania, the health care power of attorney is a writing made by a principal designating an individual, referred to as the health care agent, to make health care decisions for the principal (20 Pa. C.S.A. 5422). According to the New Mexico Statute (24-7A-1 NMSA 1978) and the Wyoming Statute, (W.S. 35-22-402), the power of attorney for health care means that an agent is designated by an individual to make health care decisions for the individual granting the power. The Georgia Statute (O.C.G.A. 31-32-2) defines the durable power of attorney for health care as a written document voluntarily executed by and individual that creates a health care agency. According to the Wisconsin Statute (Wis. Stat. 155.01), the power of attorney for health care means the designation by the individual for another to make health care decisions if the individual cannot, due to incapacity.

The New Mexico Statute (24-7A-1 NMSA 1978) and the Wyoming Statute (W.S. 35-22-402) define the agent as an individual designated in a power of attorney for health care to make a health care decision for the individual granting the power.

Right to Appointment

Under the provisions of the Massachusetts statute (Mass. Ann. Laws 201D-2), a competent adult has an express right to appoint a health care agent by executing a health care proxy. According to the Georgia Statute (31-32-5), any person of sound mind may execute a document which appoints a health care agent. The Maryland statute grants any competent individual the right to make a written or electronic advance directive appointing an agent to make health care decisions (Md. Health Code Ann. 5-602). According to the Wisconsin Statute (Wis. Stat. 155.05), an individual of sound mind may voluntarily execute a power of attorney for health care. The West Virginia Code (W.Va. Code 16-30-4) states that any competent adult may execute a medical power of attorney. The Mississippi Code (Miss. Code Ann. 41-41-201) empowers an adult to execute a power of attorney for health care which may authorize the agent to make any health care decisions that the principal could have made while having capacity.

Execution Procedure

Under the provisions of the Massachusetts statute (Mass. Ann. Laws 201D-2), the signatures of two adults are required to be present and witness the execution of a health care proxy. According to the California Code (2018 CA Prob. Code 4673), the advance health care directive must be in writing and signed by the patient or by another at the direction of the patient. and acknowledged by a notary public and two witnesses. In addition, the California Code prescribes a declaration for each witness to sign (2018 CA Prob. Code 4674). If the patient resides in a California skilled nursing facility, the patient advocate or ombudsman must also witness the advance directive (2018 CA Prob. Code 4675).

The Maryland statute specifies that a written or electronic advance directive must be dated, signed by or at the express direction of the declarant, and subscribed by two witnesses (Md. Health Code Ann. 5-602). Under the Wisconsin Statute (Wis. Stat. 155.10), the power of attorney for health care needs to be in writing, dated and voluntarily signed by the principal in the presence of two witnesses. The Wyoming Statute, (W.S. 35-22-403) indicates that the power of attorney must be in writing and signed by the principal and either be sworn and acknowledged before a notary public or signed by at least two witnesses. In addition, the witnesses are required to make a declaration that the person signing the document is personally known by the witnesses to be the principal. The Wyoming sample form in the statute provides a space for witnesses to sign the document but indicates that the witnessing is optional.

The West Virginia Code (W.Va. Code 16-30-4) states that the medical power of attorney needs to be in writing, executed by the principal, dated, and signed in the presence of two witnesses and acknowledged before a notary public. According to the California Code, the advance health care directive must be acknowledged by a notary public or signed by two adult witnesses (2018 CA Prob. Code 4673).

Witness Qualifications

In California and Wyoming, the witness may not be the treating health care provider, the health care agent nor the operator of a community care facility or a residential care facility for the elderly (2018 CA Prob. Code 4674; W.S. 35-22-403). In contrast, the Maryland statute authorizes any competent individual to serve as a witness to an advance directive, including an employee of a health care facility, nurse practitioner, physician assistant or the physician caring for the declarant if acting in good faith (Md. Health Code Ann. 5-602).

Under the provisions of the Massachusetts statute, a person named as a health care agent in a health care proxy may not witness the execution of the document (Mass. Ann. Laws 201D-2). Similarly, the Maryland statute limits the health care agent of the declarant from serving as a witness to the document (Md. Health Code Ann. 5-602). The Wisconsin Statute (Wis. Stat. 155.10) denies a relative of the principal from witnessing the power of attorney for health care as well as the treating health care provider. According to the West Virginia Code (W.Va. Code 16-30-4), the witness may not be related to the principal, entitled to any portion of the estate, directly responsible for the medical care of the principal, the attending physician or the actual medical power of attorney.

Prescribed Form

Several states have posted optional advance directive and power of attorney forms. Although the suggested forms are available within the statute, the statutes permit the individual to use a form of their choice. Under the Pennsylvania Statute (20 Pa. C.S.A. 5465), a health care power of attorney may be in any written form identifying the principal,

appointing a health care agent and declaring that the principal authorizes the health care agent to make health care decisions on behalf of the principal. An example of a health care power of attorney form is imbedded in the Pennsylvania Statute in combination with a living will (20 Pa. C.S.A. 5471).

According to the Maryland statute, the form is completely optional and other forms are also valid (Md. Health Code Ann. 5-603). The Maryland form contains two parts for the individual to state their wishes. The first part of the form lets the person pick a health care agent. The second part of the form lets the individual write their preferences about efforts to extend life in the event of terminal condition, persistent vegetative state and end-stage condition. If the individual only wants to select a health care agent, the individual would skip the completion of the second part of the form (Md. Health Code Ann. 5-602).

The Wisconsin Statute (Wis. Stat. 155.30) provides a model Power of Attorney for Health Care form for a person to use if they do not have the advice of legal counsel but the form only provides authority to make health care decisions on behalf of the principal. If an attorney prepares a customized power of attorney for health care form, the attorney is required to sign the document and certify that the attorney has advised the client concerning their rights in connection with the power of attorney for health care (Wis. Stat. 155.30).

The Wyoming Statute (W.S. 35-22-405) authorizes and prescribes a sample form for powers of attorney for health care which allows the principal to include other specific directions. The Rhode Island law provides a statutory form of durable power of attorney which contains a unique section to complete if the authority of the agent is to end on a specific date and a space to appoint an alternate agent (R.I. Gen. Laws 23-4.10-2).

The West Virginia Code (W.Va. Code 16-30-4) provides a sample form which combines the Living Will and the Medical Power of Attorney. The principal is not required to follow the West Virginia sample form and may include other specific directions not inconsistent with other provisions of the act. The Alaska Statute and the Mississippi Code (Alaska Stat. 13.52.300; Miss. Code Ann. 41-41-209) contain a sample form to create a combined advance health care directive which may be modified to suit the needs of the person. Part 1 of the sample form is a durable power of attorney for health care. The Kansas Statute (Kan, Stat. Ann. 58-632) provides a sample form for durable power of attorney for health care decisions which the principal needs to substantially follow.

According to the Ohio Code (Ohio Rev. Code Ann. 1337.17), printed forms of durable power of attorney may be sold and distributed for use by adults who are not advised by an attorney but the form must contain a detailed notice to the person using the document with informative information about limitations, rights, responsibilities and other pertinent matters.

Declaration by Principal

According to the Maryland Statute (Md. Health Code Ann. 5-602), the declarant is responsible to notify the health care agent that the agent has been named to act on their behalf. In the Maryland Statute and the Virginia Code, the declarant is responsible to notify the attending physician that an advance directive has been made (Md. Health Code Ann. 5-602; Va. Code Ann. 54.1-2982. The West Virginia Code (W.Va. Code 16-30-4) stipulates that the principal is responsible for notifying the attending physician of the existence of the medical power of attorney.

Absence of Proxy

The Maryland statute specifies that the absence of an advance directive does not create a presumption as to the patient's intent to consent or refuse life-sustaining procedures (Md. Health Code Ann. 5-602). Under the provisions of the Massachusetts statute (Mass. Ann. Laws 201D-16), a health care provider is not precluded from relying upon the informed consent of responsible parties in the absence of a health care proxy and the absence does not create a presumption regarding the wishes of the patient about health care. The Wyoming Statute and Alabama Code affirm that the absence of an advance health care directive does not create a presumption concerning the intention of an individual (W.S. 35-22-414; Ala. Code 26-1-2).

Legal Effect

The Kansas Statute (Kan. Stat. Ann. 58-626) establishes that all acts done by an agent pursuant to a durable power of attorney for health care decisions has the same effect as if the principal were competent and not disabled.

Scope of Authority of Agent

Under the provisions of the Massachusetts statute, the attorney in fact has the authority to act during any period of disability or incapacity of the principal with the same effect and bind the principal (Mass. Ann. Laws 5-502). The principal can grant broad authority to the agent allowing the agent to make all health care decisions about life-sustaining treatment (Mass. Ann. Laws 201D-5). According to the Georgia Statute (O.C.G.A. 31-32-7), the health care agent is required to exercise powers in such manner as the health care agent deems consistent with the intentions and desires of the declarant. According to the California Code (2018 CA Prob. Code 4671), the power of attorney for health care authorizes the agent to make health care decisions and may also include individual care instructions. Under the provisions of the Massachusetts statute (Mass. Ann. Laws 201D-4), the principal may impose limitations on the power granted to the agent in the health care proxy.

A unique provision in the Maryland statute empowers the declarant to designate the agent to make mental health services decisions (Md. Health Code Ann. 5-602).

Exercise of Power

According to the Georgia statute, the health care agent is permitted to sign and deliver instruments, negotiate and enter into agreements, and do acts reasonably necessary to implement the exercise of the powers granted to the health care agent (O.C.G.A. 31-32-7). Under a provision of the California Code (2018 CA Prob. Code 4671), the principal may grant the health care agent the power to make personal care decisions, concerning housing, meals, hiring household employees, transportation arrangements, the handling of mail and arranging recreation and entertainment. According to the Wyoming Statute, (W.S. 35-22-403), an adult may authorize the agent to make any health care decision the principal could have made while having capacity.

Power to Contract for Health Care Services

Under the provisions of the Georgia Statute (O.C.G.A. 31-32-7), the health care agent is authorized to contract for any health care facility or service in the name of the declarant.

Power to Consent, Refuse, Withhold or Withdraw Treatment

According to the Georgia Statute (O.C.G.A. 31-32-7), the health care agent is authorized to consent to treatment and to refuse, withhold or withdraw consent to any and all types of medical care, treatment or procedures relating to the health of the declarant. However, the Wisconsin Statute (Wis. Stat. 155.20) only permits the health care agent to consent to the withholding or withdrawal of a feeding tube for the principal if the power of attorney for health care instrument specifically authorizes the decision.

Visitation Rights

According to the Georgia Statute (O.C.G.A. 31-32-7), the health care agent is permitted to visit or consult with the declarant who is admitted to a health care facility and to accompany the declarant in an ambulance or air ambulance.

Access to Medical Information

Under Massachusetts law, the health care agent has a right to receive any and all medical information pertaining to the principal that is necessary to make informed health care decisions (Mass. Ann. Laws 201D-5). According to the Georgia Statute (O.C.G.A. 31-32-7), the health care agent has the right to examine and copy and consent to disclosure of all the medical records of the declarant. The California Code (2018 CA Prob. Code 4678) and Wyoming Statute (W.S. 35-22-408) grant an authorized person the same rights as the patient to request, receive, examine, copy and consent to the disclosure of the patient's medical information. Similarly, the Ohio Code (Ohio Rev. Code Ann.

1337.13) grants the durable power of attorney the same right as the principal to receive information, to review health care records and to consent to the disclosure of health care records.

Nondelegation of Duties

According to the Georgia Statute (O.C.G.A. 31-32-7), the health care agent is not permitted to delegate authority to make health care decisions to others.

Treatment Assessment

Under Massachusetts law, the agent is authorized to make health care decisions on behalf of the principal after consultation with health care providers and consideration of acceptable medical alternatives regarding diagnosis, prognosis, treatments, side effects and the wishes of the principal including the religious and moral beliefs of the principal (Mass. Ann. Laws 201D-5).

Best Interests Standard

When making decisions, the agent is expected to act at all times in the best interests of the principal (Mass. Ann. Laws 201D-5). The Pennsylvania statute recommends that the best interest of the patient is advanced if the health care provider initiates discussions with the patient regarding living wills and health care powers of attorney during the initial consultation (20 Pa. C.S.A. 5423 c (5)). According to the New Mexico Statute (24-7A-2 NMSA 1978) and the Wyoming Statute (W.S. 35-22-403), the agent may only make decisions in accordance with the agent's determination of the principal's best interest considering the principal's known personal values. The Maryland Health Code defines the best interest to mean that the benefits to the individual resulting from a treatment outweigh the burden to the individual resulting from that treatment (Md. Health Code Ann. 5-601).

If the intentions of the declarant are unclear, the Georgia Statute requires the health care agent to act in the best interest of the declarant considering the benefits, burdens, and risks of the circumstances and treatment options. (O.C.G.A. 31-32-7).

Due Care Standard

According to the Georgia Statute (O.C.G.A. 31-32-7), the health care agent is required to use due care for the benefit of the declarant in accordance with the terms of the advance directive for health care.

Responsibilities of Health Care Provider

According to the Georgia Statute (O.C.G.A. 31-32-8), the health care provider is required to consult with the health care agent whenever the declarant is unable to understand the general nature of a necessary health care procedure.

Notification Requirements

A health care provider who is provided with a health care proxy is required to arrange for the health care proxy or a copy of the proxy to be inserted in the medical record (Mass. Ann. Laws 201D-5). According to the Georgia Statute (O.C.G.A. 31-32-8), the health care provider who is furnished with a copy of an advance directive for health care is required to make the document a part of the medical record. The Maryland Statute and the Virginia Code require the attending physician to make the advance directive a part of the declarant's medical record (Md. Health Code Ann. 5-602; Va. Code Ann. 54.1-2982). In the West Virginia Code (W.Va. Code 16-30-4), the attending physician is required to make the medical power of attorney part of the principal's medical record.

Determination of Incapacity

Under the provisions of the Massachusetts statute (Mass. Ann. Laws 201D-6), the authority of the health care agent begins after a determination is made by the attending physician that the principal lacks capacity to make health care decisions. The express opinion of the attending physician needs to be documented in the permanent medical record,

based on accepted standards of medical judgment and contain information on the cause and nature of the incapacity as well as its extent and probable duration (Mass. Ann. Laws 201D-6).

According to the New Mexico Statute (24-7A-2 NMSA 1978) and the Wyoming Statute (W.S. 35-22-403), the authority of an agent only becomes effective upon a determination that the principal lacks capacity and ceases to be effective upon a determination that the principal has recovered capacity. In New Mexico, the determination that an individual lacks capacity is required to be made by two qualified health care professionals and the basis for establishing a lack of capacity cannot be determined by the fact that the individual chooses not to accept a recommended treatment (24-7A-10 NMSA 1978). According to the Wyoming Statute, (W.S. 35-22-403), the primary physician or supervising health care provider is required to make the determination that an individual lacks capacity.

Under the Wisconsin Statute (Wis. Stat. 155.05), the power of attorney for health care takes effect upon a finding of incapacity by two physicians who personally examine the principal and sign a statement specifying that the principal has incapacity.

Mental Illness Incapacity

According to the Massachusetts statute, if a patient lacks capacity because of a mental illness or developmental disability, the attending physician is required to order a consult with a health care professional who has specialized training or experience in treating mental illness or developmental disabilities (Mass. Ann. Laws 201D-6).

Good Faith Compliance

According to the Wisconsin Statute (Wis. Stat. 155.20), the health care agent is required to act in good faith consistently with the desires of the principal as expressed in the power of attorney for health care instrument. A health care provider is required to comply with the health care decisions made by an agent under a health care proxy, subject to any limitations in any specific court order (Mass. Ann. Laws 201D-5). According to the Georgia Statute (O.C.G.A. 31-32-8), the health care provider is required to comply with health care decisions made by a health care agent in accordance the terms of an advance directive. Likewise, the Wyoming Statute (W.S. 35-22-408) requires the health care provider to comply with health care decisions made by the authorized person for the patient.

Noncompliance Not Abandonment

Under the Pennsylvania statute, the attending physician is required to inform the principal if the attending physician cannot in good conscience comply with a health care decision of the health care agent and assist in the transfer of the principal to another physician who will comply with the health care decision of the health care agent (20 Pa. C.S.A. 5424 a). According to the Wyoming Statute (W.S. 35-22-408), a health care provider may decline to comply with an individual instruction or health care decision for reasons of conscience. In such situations, the health care provider needs to inform the patient and any person then authorized to make health care decisions for the patient and continue to provide care until a transfer can be arranged. The West Virginia Code (W.Va. Code 16-30-10) specifically indicates that the necessitation of transfer of the patient under these circumstance does not constitute abandonment on the part of the physician.

Conscience Objections

The West Virginia Code (W.Va. Code 16-30-12) stipulates that a health care facility is not required to change a public policy of the institution that is expressly based on sincerely held religious beliefs or sincerely held moral convictions central to the facility's operating principles.

Generally Accepted Health Care Standards

According to the Wyoming Statute (W.S. 35-22-408), the health care provider may decline to comply with an individual instruction or health care decision that requires medically ineffective health care or health care contrary to generally accepted health care standards. The South Dakota Statute (S.D. Codified Laws 59-7-2.5) indicates that the health care decisions by the agent need to be made in accordance with accepted medical standards.

Refusal to Honor Proxy

The Massachusetts statute preserves the right of a physician to refuse to honor a request by the health care agent if the decision is contrary to the moral or religious views of the physician (Mass. Ann. Laws 201D-14). In those situations, the physician is required to arrange to transfer the patient to another physician and if unable to arrange the transfer to seek judicial relief. According to the Georgia Statute (O.C.G.A. 31-32-8), if the health care provider is unwilling to comply with a decision of the health care agent, the provider is required to promptly inform the health care agent and provide reasonably necessary consultation and care in connection with the transfer to another health care provider. In the event that a health care provider does not intend to comply with an instruction of a health care agent, the Maryland statute provides guidelines for the provider to inform the person giving the instruction and make every reasonable effort to transfer the patient to another health care provider (Md. Health Code Ann. 5-613). Similarly, the Rhode Island Statute (R.I. Gen. Laws 23-4.10-6) requires the attending physician who refuses to comply with the durable power of attorney to transfer the patient to another physician.

Non-Retaliation for Refusal to Honor Proxy

Under the provisions of the Massachusetts statute (Mass. Ann. Laws 201D-14), the physician is protected from dismissal, suspension, demotion, failure to promote, discrimination, or the withholding of pay or financial assistance for the refusal to carry out actions requested by the agent which are contrary to the moral or religious views of the physician.

Resolution of Conflicts

In the event of a conflict between the decisions of the medical power of attorney representative and the principal's best interests as determined by the attending physician, the West Virginia Code (W.Va. Code 16-30-5) stipulates that the attending physician should attempt to resolve the conflict by consultation with another qualified physician, an ethics committee or by some other means. However, if the physician cannot resolve the conflict with the medical power of attorney representative, then the attending physician may transfer the care of the patient.

Coercion

Under the Pennsylvania statute, neither a health care provider, an insurer, or a governmental program is allowed to require an individual to designate a health care representative nor charge the individual a different rate or fee for failure to appoint a health care representative as a condition for being insured or receiving health care services (20 Pa. C.S.A. 5428).

Under the provisions of the Massachusetts statute (Mass. Ann. Laws 201D-10), health care providers and insurance carriers are prohibited from requiring the patient to execute a health care proxy. According to the Georgia Statute (O.C.G.A. 31-32-12), the health care provider and the insurer are not allowed to require a person to execute an advance directive as a condition for being insured or receiving health care services. In addition, the Georgia Statute imposes legal sanctions including civil liability and misdemeanor charges to any person who coerces or attempts to coerce a person into making an advance directive (O.C.G.A. 31-32-13).

The California Code prohibits a health care provider, service plan, institution, or insurance plan from requiring or prohibiting a person from executing an advanced health care directive as a condition for providing health care, admission to a facility or furnishing insurance (2018 CA Prob. Code 4677). According to the Wisconsin Statute (Wis. Stat. 155.70), a person who coerces, threatens or intimidates an individual to execute a power of attorney for health care instrument is subject to a fine or imprisonment. The West Virginia Code (W.Va. Code 16-30-23) expressly prohibits a health care facility to deny a person admission to the facility on the basis of the presence or absence of a medical power of attorney. The Tennessee Statute, Tenn. Code Ann. 34-6-211) prohibits a health care provider, medical service plan, health maintenance organization, or similar medical plans from conditioning admission to a health care institution, or providing treatment or insurance on the requirement that a patient execute a durable power of attorney for health care.

The Pennsylvania Statute (20 Pa. C.S.A. 5432) makes it a felony of the third degree to cause a person to execute an advance health care directive or order or wear a bracelet or necklace by undue influence, fraud or duress.

Life Insurance Validation

The Pennsylvania statute stipulates that the withholding of life-sustaining treatment from an insured individual does not impair or invalidate a life insurance policy nor affect the sale, procurement or issuance of a life insurance policy (20 Pa. C.S.A. 5427). According to the Georgia Statute (O.C.G.A. 31-32-11), the making of an advance directive is not a valid reason to restrict, inhibit, or impair the sale, procurement, issuance, or enforceability of a policy for life insurance, an annuity, or other contract that is conditioned on the life or death of the declarant. No insurer in Wisconsin may refuse to pay for goods or services covered under a principal's insurance policy because decisions were made by the health care agent (Wis. Stat. 155.70). The Wyoming Statute (W.S. 35-22-414) asserts that a death resulting from the withholding or withdrawal of health care does not constitute a suicide or homicide or impair or invalidate a policy of insurance or annuity. The West Virginia Code stipulates that a life insurance or annuity or other type of contract is not legally impaired or invalidated by the withholding or withdrawal of life-prolonging intervention from an insured person (W.Va. Code 16-30-14). The Tennessee Code is broader in scope by stipulating that a life insurance policy is not legally impaired or invalidated in any manner by the withholding or withdrawal of health care from an insured principal (Tenn. Code Ann. 34-6-213).

Health Care Costs

Under the provisions of the Massachusetts statute (Mass. Ann. Laws 201D-9), the cost of health care is the same for decisions made by the agent as if the health care were provided by the principal.

Restrictions

Under the provisions of the Massachusetts statute (Mass. Ann. Laws 201D-12, suicide or mercy killing or acts to end one's own life are impermissible. The Pennsylvania statute indicates that the durable power of attorney law does not condone, authorize or approve mercy killing, euthanasia or aided suicide (20 Pa. C.S.A. 5423(a)). According to the Georgia statute (O.C.G.A. 31-32-14), the advance directive law does not condone, authorize or approve mercy killing or permit any affirmative or deliberate act or omission to end life other than to permit the natural dying process. Nothing in the Wisconsin Statute may be construed to condone, authorize, approve or permit any affirmative or deliberate act to end the life of a person other than the withholding or withdrawing of health care under a power of attorney for health care (Wis. Stat. 155.70). The Wyoming Statute (W.S. 35-22-414) stipulates that the act does not authorize mercy killing, assisted suicide, or euthanasia.

Interpretation of Cause of Death

Under the Pennsylvania statute, the withholding or withdrawal of life-sustaining treatment from a principal resulting in death in accordance with the durable power of attorney provisions does not constitute suicide or homicide (20 Pa. C.S.A. 5426). According to the New Mexico statute, the withholding or withdrawal of health care in accordance with the Uniform Health Care Decisions Act does not constitute a suicide, homicide or other crime (24-7A-13 NMSA 1978). According to the Georgia Statute (O.C.G.A. 31-32-11), the making of an advance directive containing directions regarding withholding or withdrawal of life-sustaining procedures does not constitute a suicide. Under the Wisconsin Statute (Wis. Stat. 155.70), the making of a health care decision on behalf of a principal under the power of attorney for health care instrument does not constitute suicide.

Palliative Care

Under the provisions of the Massachusetts statute (Mass. Ann. Laws 201D-13, medical procedures and treatment to provide comfort care or pain alleviation with sedatives and pain-killing drugs, non-artificial oral feeding suction and hygenic care may be administered by the attending physician to patients with health care proxies. According to the Georgia Statute (O.C.G.A. 31-32-8), the health care provider has the right to administer treatment for the comfort or alleviation of pain to the declarant. The South Dakota Statute (S.D. Codified Laws 59-7-2.7) prohibits the agent or attorney-in-fact from withholding or withdrawal of comfort care from the principal.

Eligibility of Health Care Agent

Under the provisions of the Massachusetts statute (Mass. Ann. Laws 201D-3), an operator, administrator or employee of a facility is ineligible to be appointed as a health care agent for the patient or resident in that facility. According to the Georgia statute (31-32-5d), the physician or a health care provider directly involved in the health care of the patient is prohibited from serving as the declarant's health care agent. The Wisconsin Statute (Wis. Stat. 155.05) restricts the health care provider from acting as a health care agent. However, the Georgia health care facility may prepare or offer to prepare the advance directive for the person, if the person desiring to execute an advance directive specifically requests assistance (O.C.G.A. 31-32-12). According to the Wyoming Statute, (W.S. 35-22-403), the agent cannot be an owner, operator or employee of a residential community care facility at which the principal is receiving care.

Presumption of Durable Power of Attorney

Under the provisions of the Massachusetts statute (Mass. Ann. Laws 5-502), a health care proxy is presumed to be properly executed unless a court determines otherwise. According to the California Code (2018 CA Prob. Code 4676), a physician may presume that a written advance health care directive executed in another state or in California is valid in the absence of knowledge to the contrary. Similarly, the Rhode Island Statute (R.I. Gen. Laws 23-4.10-10) indicates that a physician, health care provider or emergency medical services personnel may presume that a durable power of attorney is valid and complies with applicable requirements in the absence of actual notice to the contrary.

Revocation of Proxy

Under the provisions of the Massachusetts statute (Mass. Ann. Laws 201D-7), a principal may revoke a health care proxy by notifying the agent or the health care provider of the specific intent to revoke the proxy. The Ohio Code (Ohio Rev. Code Ann. 1337.14) affords the principal the ability to revoke a durable power of attorney at any time and in any manner. According to the New Mexico Statute, the Alaska Statute and the Mississippi Code, a principal while having capacity, may revoke the designation of an agent by a signed writing or by personally informing the supervising health care provider (24-7A-3 NMSA 1978; Alaska Stat. 13.52.020; Miss. Code Ann. 41-41-207). However, under the Wyoming Statute (W.S. 35-22-404), the individual with capacity may only revoke the designation of an agent by a signed writing.

The Wisconsin Statute (Wis. Stat. 155.40) contains a provision for the principal to revoke a power of attorney for health care at any time unless the principal is adjudicated incompetent. Under those circumstances, the court may revoke the power of attorney for health care for good cause (Wis. Stat. 155.40).

Alternate Representative

Under the provisions of the Massachusetts statute (Mass. Ann. Laws 201D-2), a competent adult is permitted to designate an alternate health care agent to serve when the primary health care agent is unavailable, unwilling or incompetent to serve the role. The Wisconsin Statute (Wis. Stat. 155.05) affords the principal the opportunity to designate an alternative individual to serve as the health care agent in the event the first health care agent is unable or unwilling to serve.

Reliance on Authority

Under the provisions of the Massachusetts statute (Mass. Ann. Laws 201D-8), a health care provider is protected from criminal or civil liability for carrying out in good faith a health care decision by an agent pursuant to a health care proxy. In addition, the agent is also protected from criminal or civil liability for making a health care decision in good faith pursuant to a health care proxy (Mass. Ann. Laws 201D-8). The Pennsylvania statute protects the attending physician from criminal or civil liability or administrative sanctions for failure to carry out a health care decision of a health care agent if the physician is unable to arrange the transfer of care to another physician and provides life-sustaining treatment to a principal (20 Pa. C.S.A. 5424 d).

The New Mexico Statute (24-7A-9 NMSA 1978) and the Wyoming Statute (W.S. 35-22-410) grant immunity to a health care provider acting in good faith and in accordance with generally accepted health care standards and waives the provider from civil or criminal liability and from discipline for unprofessional conduct for complying with a health

care decision for the patient by the agent. In addition, the individual acting as an agent is not subject to civil or criminal liability for health care decisions made in good faith (24-7A-9 NMSA 1978).

According to the Georgia Statute (O.C.G.A. 31-32-10), the health care provider who acts in good faith reliance on any direction or decision by the health care agent is protected and released from civil or criminal liability or discipline for unprofessional conduct for complying with any direction or decision by the health care agent, even if the declarant dies or is injured. In addition, the health care agent is not subject to civil or criminal liability who in good faith acts with due care for the benefit of the declarant and in accordance with the terms of an advance directive.

According to the West Virginia Code (W.Va. Code 16-30-10), the physician is not subject to criminal or civil liability for good-faith compliance or reliance upon the directions of the medical power of attorney representative.

Reciprocity of Foreign Proxies

Under the provisions of the Massachusetts statute (Mass. Ann. Laws 201D-11), a health care proxy executed in another state is enforceable within its jurisdiction where the patient is living. According to the New Mexico statute, a durable power of attorney executed in another state is considered valid and enforceable in New Mexico (24-7A-16 NMSA 1978). According to the California Code (2018 CA Prob. Code 4676), a written advance health care directive executed in another state is valid and enforceable in California. A document executed in another state is valid and enforceable in Wisconsin to the extent that the document authorizes the health care agent to make decisions for the principal (Wis. Stat. 155.70). According to the West Virginia Code, the Rhode Island Statute and the Alabama Code, a medical or durable power of attorney executed in another state is considered validly executed and in compliance with the laws (W.Va. Code 16-30-21; R.I. Gen. Laws 23-4.10-11, Ala. Code 26-1-2).

Priority Over the Person

According to the Georgia statute (O.C.G.A. 31-32-14), the known health care agent who is available and willing to make health care decisions for the declarant has priority over any other person, including a guardian, to act for the declarant in all matters covered by the advance directive for health care. An agent appointed under provisions of the Maryland statute has decision making priority over any individuals otherwise authorized to make health care decisions for a declarant (Md. Health Code Ann. 5-602). Under the Wisconsin Statute (Wis. Stat. 155.20), the health care agent has priority over any individual to make health care decisions for the principal. According to the Wyoming Statute (W.S. 35-22-407), a health care decision of the agent takes precedence over that of a guardian absent a court order to the contrary.

Appointment of Guardian

Under the provisions of the Massachusetts statute (Mass. Ann. Laws 5-503 b), the principal of a durable power of attorney may nominate a guardian of the person for consideration by the court in a future protective proceeding. According to the California Code (2018 CA Prob. Code 4672), the principal may nominate a conservator or a guardian of the person or estate for court consideration in the event protective proceedings are commenced. According to the Wyoming Statute (W.S. 35-22-403), a written advance health care directive may include the individual's nomination of a guardian of the person.

In the event of the appointment of a guardian or receiver for the declarant by a Georgia probate court or superior court, the court order may not usurp the authority of a health care agent unless notice is sent to the health care agent and convincing evidence is presented that the health care agent is acting in a manner inconsistent with the power of attorney (O.C.G.A.31-32-6).

Validity Disputes

Under the provisions of the Massachusetts statute (Mass. Ann. Laws 201D-17), a special proceeding in a court of law is permissible to resolve the validity of the health care proxy, resolve the unavailability of the agent, remove the agent acting in bad faith or override the decision of the agent made in bad faith. According to the Georgia statute (O.C.G.A. 31-32-7), the court may remove a health care agent upon a finding that the health care agent is not acting properly.

Disciplinary Sanctions

The Pennsylvania statute subjects a person to prosecution for criminal homicide for falsifying or forging an advance health care directive, order, bracelet or necklace of the patient or willfully conceals or withholds personal knowledge of a revocation of an advance health care directive causing the withholding or withdrawal of life-sustaining treatment contrary to the wishes of the patient (20 Pa. C.S.A. 5432). The Georgia statute imposes legal sanctions and penalties including civil liability, misdemeanor charges and homicide charges to any person who, without the consent of the declarant, willfully conceals, cancels, alters, falsifies or forges an advance directive (O.C.G.A. 31-32-13). According to the Wisconsin Statute (Wis. Stat. 155.70), a person who knowingly conceals, falsifies or forges a power of attorney is subject to civil and criminal prosecution. Similarly, the Rhode Island Statute (R.I. Gen. Laws 23-4.10-8) makes it a crime to willfully conceal, cancel, deface or obliterate the durable power of attorney.

Statutory Damages

According to the New Mexico statute, a health care provider that intentionally violates provisions of the Uniform Health Care Decisions Act is subject to statutory damages (24-7A-10 NMSA 1978). Under the Wyoming Statute (W.S. 35-22-411), violations of the statute subject the health care provider that acts willfully or with reckless disregard to the patient's instruction or health care decision to statutory damages.

Discretionary Authority

The Wisconsin Statute (Wis. Stat. 155.65) authorizes the register in probate of the county to retain on file for a fee the principal's power of attorney for health care instrument for safekeeping. Under the Mississippi Code (Miss. Code Ann. 41-41-229), the patient, the agent, guardian, surrogate or a health care provider may petition any court of competent jurisdiction to enjoin or direct a health care decision or order other equitable relief.

Discussion

The fundamental principle underlying the concept of the durable power of attorney is the protection of the person's right to the self-determination of health care decision making especially if the person becomes incapacitated. The durable power of attorney is an effective means for conveying the express appointment of an agent to act on behalf of the principal in health care matters. This doctrine means that a person has the right to accept or reject medical or surgical treatment. In the event, the person is unable to make medical decisions, then the designated agent or health care representative has the authority to intervene on behalf of the principal.

Several of the laws have specific protection provisions which uphold the right of patient autonomy and stymie outside influence. The Georgia laws impose some of the strongest measures against coercion, forgery, concealment and other forms of tampering with the advance directive of a person.

The formatting of the durable power of attorney varies among the state statutes. Some states have standalone durable power of attorney forms. Other states combine the durable power of attorney form and the living will form. The Georgia statute has combined the advance directive and the durable power of attorney format into one document and legislated one statute to address both doctrines.

The scope of authority of the agent varies by state. The statutes enable the patient to decide the breath of the powers available for the health care agent. The California code authorizes the agent to make health care decisions and permits the principal to include predetermined individual health care instructions. Other statutes permit the health care agent to determine the right to contract, the power to refuse treatment, visitation rights, and access to medical information.

Guardianship matters raise special concerns. Usually, the courts have jurisdiction over guardianship proceedings. The California and Massachusetts laws allow the principal to nominate the name of a guardian if protective proceedings are commenced. Although the court may consider the request, it is not obligated to appoint the nominee.

Most statutes outline specific criteria for qualifying the witnesses to the durable power of attorney. These statutes differ in the approach to witness qualifications. The Maryland statute takes a broad approach which enables any competent individual to serve as a witness. The Wisconsin Statute denies a relative of the principal from witnessing

a power of attorney for health care. This provision seems unnecessary unless the witness could have a claim on any portion of the principal's estate which could be viewed as a conflict of interest. The Wyoming sample form is confusing because it provides a space for witnesses to sign but indicates that the witnessing is optional.

Health care decisions involve more sensitive matters than decisions affecting the disposition of financial or property matters. The durable power of attorney allows an agent to determine health care decision of the person. The durable power of attorney affords the patient an opportunity to execute and designate a health care agent to act on their behalf in the event the patient is unable to make decisions or becomes incapacitated. The patient can plan for future medical contingencies. By designating a health care agent, the health care provider can rely on the health care decisions of the agent on behalf of the patient.

Although it may be difficult for an individual to draft a durable power of attorney, many third-party agencies provide forms for the individual to complete with simple instructions.

The statutes give the patient the option to decide for themselves whether a durable power of attorney is appropriate. The patient may select someone that the patient trusts. The designated agent can assure that the patient receives the appropriate care. The health care agent can confer with the providers and determine the proper care in accordance with the desires of the patient. The health care agent can assess the risks and benefits of the available treatment options. Another important feature of the durable power of attorney is the ability of the health care agent to have access to medical information.

If the patient has completed a Living Will, the health care agent will have a better understanding of the wishes of the patient. However, a standalone Living Will may create a problem because the directive may not encompass or foresee all the variations of illnesses and treatment options of the actual circumstances. Therefore, a supplemental Durable Power of Attorney document enables the health care agent to interpret the intent of the written instructions.

The statutes vary by jurisdiction and may not be uniform in scope. Some statutes obligate the health care agent to acknowledge their responsibilities in writing to emphasize their commitment to make critical health care decisions on behalf of the principal. Fundamentally, the underlying right to choose treatment is made by the patient in consultation with the patient's health care provider and the patient's health care team.

The state statutes make vague references to health care standards. These statutes indicate that the instructions or health care decisions of the provider are required to conform with generally accepted health care or medical standards. However, the laws do not provide references to specific standards.

Treatment decisions are typically made between the patient and the physician under the doctrine of the right of self-determination. The durable power of attorney concept enables the health care agent to assume that patient right of self-determination. In a typical health care arrangement, the patient develops a relationship with the physician before a health care agent is required. The patient selects the treatment from among alternatives identified by the physician. Once the patient becomes incapacitated, then the agent assumes responsibility for health care decisions on behalf of the principal.

The durable power of attorney delegates authority to the agent and shifts the future decision-making process to the health care agent with the recommendation of the physician. Under this model, the best interests of the patient are maintained. Many of the statutes contain provisions to address the best interests of the patient, the use of due care and to act with good faith compliance. The durable power of attorney legislation provides these extra safeguards for the patient.

Implications

The state legislation for the health care power of attorney has existed for several decades. However, questions can occur in overseeing the care of the patient and making health care decisions when the patient becomes incapacitated. To implement a durable power of attorney, the physician and health care agent will need to communicate effectively so that the agent has a thorough understanding of the potential benefits and risks of treatment.

To improve the health care guidelines, the statutes may mandate that the state medical licensure boards develop clinical review criteria for patients with special needs. The statutes may specify provisions for clinical guidelines to address matters of atypical patient populations. The durable power of attorney statutes may require further modification to clarify certain situations. One of the criteria that requires more specificity is the exceptions process for patients with special needs. The treatment plan criteria for special needs may have already been predetermined and based on current standards of direct patient to physician contact. The statutes may require relevant patient protection measures that address safeguards for patients with physical impairments and special needs.

The issue of the transfer of care to other health care providers raises concerns regarding the continuity of care and the transfer of clinical information and lack of familiarity with the patient's medical history. To improve care, the receiving physician and the health care agent may need to have a thorough discussion about the future treatment plan after the transfer of care.

The statutes seem to encourage the dissemination of information to the consumer concerning the availability of durable power of attorney options. However, the creation of a state task force may develop guidelines to aid health care institutions in implementing the durable power of attorney process.

The statutes may stipulate standards to integrate the durable power of attorney documents with the electronic medical record. This mechanism would enable the patient to communicate their preferences to others. The digital record of the durable power of attorney would enhance the ability of the patient to convey their selection of a personal representative. The information tool would create a platform to retain the relevant information.

The state health departments may consider establishing a power of attorney hotline as a resource to provide guidance and answer questions related to the operation of the durable power of attorney process.

The state health department may develop or assist health providers in developing in-service training modules for employees that raise the level of awareness for the durable power of attorney process.

State regulations could require health care institutions to appoint internal counselors to answer questions from the staff regarding the durable power of attorney forms that are presented during the admission or registration process or during the patient stay in the facility.

At the county level, an administrative agency could provide a centralized registry to serve as a clearing house for persons to submit their durable power of attorney forms. The registry would be accessible for health care providers to query for information.

The statutes may address annual filing requirements to report the frequency of use of the durable power of attorney encounters to the health department and the state medical licensure board. The statutes may stipulate that the prescribing practitioner demonstrates with sound clinical evidence that the health care agent understands the risks, benefits and alternatives to treatment for the patient.

As discussed in this paper, many states have statutes setting forth the duties and responsibilities of physicians in the power of attorney concept. In the process, the provider may encounter a situation that could expose the patient to potentially risky and ineffective treatments expose the patient to potentially harmful outcome. Should a conflict occur between the decisions of the power of attorney representative and the patient's best interests, the physician may require clear measures to resolve the conflict. Some statutes leave the options to these dilemmas unaddressed in the law.

Limitations

The scope of research in this paper is limited to an analysis of state legislation concerning the functioning of the durable power of attorney of health care component of the advanced directives laws. This analysis does not address durable power of attorney requirements for specialty provisions involving the treatment of minors, treatment of pregnancy and research protocols and the protection of human research subjects. Issues concerning appointment of guardian of the person or estate or guardianship proceedings in this project are limited to a review of the choice of the patient to give preference to a designated nominee. The paper does not address the elements of living wills, physician orders for life-sustaining treatment (POLST) or do not resuscitate (DNR) matters.

FUTURE CONSIDERATIONS AND CONCLUSION

The findings of the study demonstrate that states recognize the right of individuals to plan for health care decisions through the execution of durable power of attorney documentation and to designate an agent to make health care decisions on their behalf. This individual right survives if a person loses their decision-making capacity and is no longer able to make their own health care decisions.

A competent adult should have the right to make their own health care decisions without the need for third party intervention. The health care agent is an extension of this same fundamental right in the event the person is unconscious, incapacitated or incapable of making their own health care decisions. This approach respects the rights of the person after they are no longer able to participate in decisions about themselves.

The current health care industry framework for defining the legal requirements of obtaining a durable power of attorney appears to be comprehensive and carefully drafted. Many safeguards have been incorporated and potential risks have been addressed.

With the rapid advances in the practice of medicine, a person needs to understand the risks and benefits of these sophisticated surgical procedures and medical treatments. If the individual is unable to speak for themselves, then another authorized representative should be allowed to act in the patient's best interests and protect the interests of the incapacitated person.

State governments have taken measures to clarify and streamline the regulatory process to secure the durable power of attorney by the patient. Courts will need to determine whether other health care providers in addition to the treating physician have a legal duty to comply with the express wishes of the patient. If a health care provider other that the physician retains a degree of participation and control in the patient's treatment, the court may determine a duty on the part of the other providers to follow the established durable power of attorney.

Future research may examine aspects of the durable power of attorney laws including the frequency of use, the lack of availability of the health care agent, the resolution of conflicts and noncompliance with health care agent decisions.

The impact that the durable power of attorney has on the quality of patient care should be considered in future research including measures of performance. The results of these encounters by the medical community need to be documented in the medical literature for the advancement of science.

Further research is needed to determine if the practice of designating a durable power of attorney provides efficiency in the delivery of care and serves the best interests of the patient. The delegating of authority may require ongoing monitoring and training of health care providers and community members.

To protect the patient, the durable power of attorney statutes may require monitoring to determine if the best interests of the patient are being maintained. Another safeguard for inclusion in the durable power of attorney legislation may provide for a second independent evaluation by a board-certified physician in an appropriate specialty if the decisions of the health care agent of the patient are in doubt.

The patient may be coerced into making appointment of health care agent decisions regarding their treatment options despite the possibility of exposure to unforeseeable risks and consequences. Therefore, the administrative agencies responsible for the formulation of health care policies may uphold the right of patients to make their own autonomous health care decisions that are independent from third party influence.

The concept that a durable power of attorney may be presumed to be valid is very important so that the care of the patient is uninterrupted, and the designation of agent by the principal is acknowledged.

Courts have long recognized the special relationship between the patient and the physician. Future statutory frameworks need to uphold the preservation of the patient-physician relationship.

Public policy needs to assure that the right of the patient to designate a health care agent is not limited by legislative changes in the law. Our society has championed the principles of the patient-physician relationship and the patient right of self-determination. Our social policies should always preserve these patient rights and afford an individual the opportunity to designate a health care agent to make health care decisions on their behalf.

REFERENCES

Alabama Code, Durable Power of Attorney Act, Ala. Code 26-1-2 (1997).

Alaska Statute, Alaska Stat. 13.52.010 (2017).

American Medical Association, AMA Ethics Policy H-140.845. Retrieved at: https://policysearch.ama-assn.org/policyfinder/detail/advance%20directive?uri=%2FAMADoc%2FHOD.xml-0-376.xml

California Code, Uniform Health Care Decisions Act, 2018 CA Prob. Code 4671 (2018).

CMS Manual System, Interpretive Guidelines for Hospitals, 42 CFR 482.13(b)(2). Retrieved at: https://www.cms.gov/Regulations-and-Guidance/Guidance/Transmittals/downloads/R37SOMA.pdf

CMS Manual System, Survey Protocols for Long Term Care Facilities, 42 CFR 483.10(b)(8). Retrieved at: https://www.cms.gov/Regulations-and-Guidance/Guidance/Transmittals/downloads/R5SOM.pdf

Georgia Code Annotated, Advance Directives for Health Care Act, O.C.G.A. 31-32-1 (2010).

In Re Sylvester, 409 Pa. Super. 439 (1991).

In Re Duran, 2001 Pa. Super. 52 (2001).

Kansas Statute Annotated, Durable Power of Attorney for Health Care Decisions Act, Kan. Stat. Ann. 58-632 (2016).

Maryland Code Annotated, Health Care Decisions Act, Md. Health Code Ann. 5-601 (2013).

Massachusetts Statute Annotated, Mass. Ann. Laws 201D-2.

Massachusetts Statute Annotated, Mass. Ann. Laws 5-501.

Mississippi Code, Uniform Health Care Decisions Act, Miss. Code Ann. 41-41-201(1998).

New Mexico Statute, Uniform Health Care Decisions Act NMSA 24-7A 1-17 (1978).

Ohio Code, Power of Attorney for Health Care Act, Ohio Rev. Code Ann. 1337.13 (2017).

Pennsylvania Consolidated Statute, 20 Pa. C.S.A. 5421-5471 (2006).

Rhode Island Statute, Health Care Power of Attorney Act, R.I. Gen. Laws 23-4.10-11 (2014).

South Dakota Statute, S.D. Codified Laws 59-7-2.5 (2007).

Tennessee Statute, Tenn. Code Ann. 34-6-201 (1990).

Title XVIII, Medicare Act, 42 USC 1395.

Virginia Code, Va. Code Ann. 54.1-2982 (2017).

West Virginia Code, West Virginia Health Care Decisions Act, W.Va. Code 16-30-4 (2017).

Wisconsin Statute, Wis. Stat. 155.01 (2019).

Wyoming Statute Annotated, Wyoming Health Care Decisions Act, W.S. 35-22-401(2014).

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THE CHANGED NATURE OF MONETARY POLICY

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ABSTRACT

In 1968 Andersen and Jordan published a strong regression result relating money growth to the economy, specifically nominal GDP. Graph 1 shows an even stronger relation of money and real GDP. But, in 2015, Lucas and Nicolini noted that, "Long standing empirical relations connecting monetary aggregates like M1, M2, and the monetary base to movements in prices and interest rates began to deteriorate in the 1980s and have not been restored since". In 2017, Xi Wang of Washington University found that, "It appears that the period 1955-80 is the only period during which the QTM (Quantity Theory of Money) fits data well - - It starts to breakdown when we go beyond this period". Our regressions of their time periods: 1985-2015 and 1985-2017 plus 1985-2020 agree with the breakdown as the GDP - M relation turned from strongly positive to negative.

We think we have an explanation as to why the GDP - M relation changed. Graph 2 shows that Fed behavior during recessions changed radically in the last three (2000-1, 2008-9, 2020) compared to those of 1948-9 to 1981-2 and also 1937-8. Prior to 1981-2 recessions were Fed induced, presumably to combat inflation. In the last three recessions the Fed made rescue attempts to lessen the effects of the dot.com crash, the CDO-Lehman "Great Recession." financial crash, and the Covid-19 Pandemic. The 1990-1 recession behavior was a transition.

The Fed has always been concerned with controlling interest rates. Three weeks after the Lehman bankruptcy on September 15, 2008 at the heart of the Great Recession, the Fed began paying interest on bank reserves (IOR) as a new way to control short term rates, radically changing the nature of monetary policy. Then came ZIRP (zero interest rate policy), difficulties at the ZB (zero interest rate bound), and QE (Quantitative Easing). Japan has been at the ZB and so has the U.S. in 1938-40, 2010-16, and 2020. What are the consequences?

INTRODUCTION

Paul Volcker's defeat of the Great Inflation in 1980-2 was a highlight of monetary policy. See Meltzer Vol. 2 p.1019-1117 (Meltzer, 2014) for a full description. A short version is that the only way to get rid of an entrenched inflation appears to be a two- stage process. The main stage is to cause a recession with its increased unemployment rate (reaching 10.8% in late 1982) which lowers demand and inflation. The question is how to cause a recession. The answer comes from Graph 1 which comes from the St. Louis Federal Reserve Bank's FRED data base. The Fed causes money growth to drop which causes GDP to drop. If Volcker had known of another way to get rid of Inflation without the cost of high unemployment, something that his predecessors Martin, Burns, and Miller along with economists such as Tobin, Ackley, and Heller had hoped for, presumably he would have used it.

A brief history of the Fed and inflation 1936 - 1982. Even though the U. S. was still in the Great Depression in 1936 there was mild inflation of 4% along with huge excess reserves in the banking system which if lent out could have, in theory, led to more inflation. So, the Fed contracted the money stock by doubling bank reserve requirements and other operations. The sharp contraction in the money stock led to the severe recession of 1937-8 and inflation disappeared. Another effect of this event was that short -term rates (3 mo. T-Bill rate) went to the zero bound ZB. Note: there was no Federal Funds rate (iFF) at the time because there was no need for interbank borrowing because of the huge excess reserve surplus. This ZB problem is deferred to a later section.

All of the post WWII recessions were preceded or accompanied by drops in the money growth rate as seen in Graph 1 (FRED money data begin in 1959, 1929-1958 available from Rasche, Monetary Aggregates, St Louis Fed website). The 1948-9 recession got rid of the vestiges of the WWII inflation, 1953-4 the vestiges of the Korean War inflation, and 1957-8 the inflation of 1956-7. The minor recession of 1960-1 reduced year over year (YOY) inflation from 1.44% to 1.01%. The mini-recession of 1966-7 reduced inflation from 3.3% to 2.7%. The very mild recession of 1969-70 reduced inflation from 5.5 to 5.1%. The severe recession of 1974-5 was complicated by the OAPEC oil boycott and oil price rise of 1973-4 with inflation peaking at 10.9%. But by mid-1976 inflation was down to 5.5%. Finally, the double recession of 1980 and 1981-2 lowered inflation from the Iran oil crisis peak of 10.2% to 3.6% in 1983.

In summary, the Fed was more or less continuously fighting inflation every 3 to 5 years from WWII to the Volcker solution in 1981-2. The procedure to oppose inflation was to slow money growth to cause a recession which then would slow inflation. The problem with the anti -inflation efforts of 1966 and 1969 was that the Fed quit too early. And the Nixon price and wage control program of August 15, 1971 did not work either

A CHANGE IN FED RECESSION RESPONSES

Fed induced recessions (recessions of 1937-8 and 1948 to 1981 were amused by the reducing money growth and then GDP. Recession correlations and regression coefficients are strongly positive. See Table Graph 2 shows totally different behavior for the last three recessions of 2000-1, 2008-9, and 2020.See Table 2. Instead of going down with GDP, money went up in the opposite direction. In these recessions correlations and regression coefficients are strongly negative. The question is: what caused the Fed to change its behavior?

The post 1984 recessions were caused by exogenous or quasi-exogenous events rather than a fear of inflation which governed pre 1984 behavior. The current 2020 recession is easy to analyze. It was caused by the Covid 19 Virus, a truly exogenous event. The 1990-1 was caused by the 3rd oil crisis and the Iraq-Kuwait 1st Gulf War, another exogenous event. The causes of the 2001 and 2009 recessions are a bit more complicated. The 2001 recession is a bit strange. It is the weakest of all the recessions covered in this paper and has an unusual pattern. Here are the real GDP figures from NIPABEA tables for the last half of 2000 and all of 2001: 13178, 13260, 13223, 13300, 13245, 13281. The % changes are: .62, -.28, .58, -42, .27.

Two small declines separated by a larger gain. Note: all other recessions have two successive declines, except 19601 which has the pattern 2.25, .54, .49, 1.28, .67. The quasi-exogenous cause was the dot.com stock market crash of March 2000 to October 2002 with the S&P500 down 45% and Nasdaq down 78%comparable to the January 1973-December, 1974 crash of 52% adjusted for inflation. The economy turned down in 4Q2000 and the money growth rescue operation started a quarter later. To understand what happened in the Great Recession of 2009 we need some statistics and history. In 4Q07 the economy grew .61%.

In 1Q08 the economy fell .57% featuring the collapse of Bear Stearns. But in 2Q08 the economy grew .52%. The real recession started on September 6 when the Treasury had to take over Fannie and Freddie (Federal National Mortgage and Federal Home Loan Mortgage) followed by the bankruptcy of Lehman Brothers on September 15. Money market funds held Lehman commercial paper so runs began on money market funds and the FDIC bailed out the funds with the Temporary Liquidity Guarantee Program on the 19th. Also, on the 15th Merrill-Lynch was taken over by Bank of America. On the 16th came the $85 billion bailout of AIG, On the 22nd, Goldman Sachs and Morgan Stanley converted from being investment banks to commercial banks to gain protection from the Fed and FDIC. On the 25th Washington Mutual (WAMU) became the 5th largest bank failure ever and was bought by J. P. Morgan. On October 3, Wachovia Bank, the fourth largest in the country at the time had to be rescued by Wells Fargo. There was more but it is clear this was a panic rivalling the bank collapses in the Great Depression. On October 3, a rescue operation known as TARP (Troubled Asset Relief Program) became law as part of the Emergency Economic Stabilization Act, a $400+ billion bailout. On October 6 the Fed began paying interest to banks on their reserves which is discussed in detail in a later section.

The net result is that the Fed contributed to the rescue effort with M2 growth rates of 13.59 and 13.42% (annual rate) for 4Q08 and 1Q09. When the Fed extended its operations to purchasing long term Treasuries, Agency securities, and eventually mortgage backed securities (WSHOMCB on FRED) the operations became known as Quantitative Easing (QE).

Summary

The relation between GDP and money (M1 or M2) became negative in the last three recessions as the Fed engaged in rescue operations of exogenous events. Prior to 1983 GDP and money were positively related. Tables 1 and 2 in the Appendix contains GDP - Money regressions of pre and post 1983 recessions. All the pre-1983 regressions are positive and significant and the last three negative and significant. In the 1990-1 Kuwait incident the Fed basically did nothing and the result is insignificant.

GDP - M REGRESSIONS OVER THE WHOLE BUSINESS CYCLE

The regressions of Tables 1 and 2 cover only the recession portion of the business cycle. We also want to know how GDP and M relate during the non-recession portion and over the whole cycle. We can define the whole cycle as a recovery sub-period then a recession, then the next cycle as the next recovery period plus the next recession and so on. Using Robert Rasche's money data (dotted line on Graph 3a) from FRED: Monetary Aggregates, we have extended the analysis back to the 1953-4 recession cycle.

Table 3 has 3 sections. The top section contains regressions of growth prior to the designated recession, or the non-recession sub-period of the cycle. The second section has regressions of the recessions, a repeat of Table 1 with the addition of the recession of 1953-4 and the mini-recession of 1966-7. The mini-recession seems to have disappeared from modern analysis but clearly appears as a business cycle in Graph 3a. It is discussed in Meltzer (p.493, 525). It is fairly ll known that the BEA has had problems with seasonal adjustments which is why it was more noticeable in older data. The third section is regressions of the whole cycle, the non-recession period and the recession period together.

All of the pre-1983 recessions are strongly related to money with a significant positive sign except the mini-recession which is positive but only at the 8.4%level. The last 3 recessions featuring rescue operations are significantly negative. The omitted 1990-1 Kuwait recession had an adjR2 of -.013, with p-value .3949, insignificant.

Now let us look at the GDP - M regressions during non-recession or growth or recovery periods in the top section of Table 3. The striking feature is that 5 of the 7 pre-1983 events are insignificant. The other two are positive. Of the three rescue cycles one non-recessionary period is positive and the other two were negative. The negativity of the runup to the 2020 recession is a bit weak perhaps because the 2010 to 2Q16 period was essentially at the ZIRB (zero interest rate boundary). At the ZIRB money (cash, demand deposits, passbook saving, MMDAs, money market funds) is virtually indistinguishable from 3 month and shorter Treasury Bills. Having surplus money has no penalty at the ZIRB compared to say 1981 when the T-Bill rate was about 14%Then people tried to hold the bare minimum of cash and zero interest demand deposits because of the opportunities elsewhere. Behavior in ZIRB conditions is discussed below.

Net observation: the influence of money on the economy is stronger during recessions than during non- recession.
GDP - M during the whole cycle. Pre-1983 all cycles are positive as expected from conventional monetary theory. For the last three cycles the relationship is negative following the recessionary behavior. What is happening is that recessionary behavior is dominating non-recessionary behavior. This is due to the nature of OLS (ordinary least squares) regressions. In OLS deviations are squared. Thus, a deviation of 2 has four times the influence of a deviation of 1. And in the business cycle where do the biggest deviations tend to occur? In recessions.

OTHER DEFINITIONS OF MONEY

Noting how money had lost its relations to other economic variables. Lucas and Nicolini developed a measure called "New M1". Basically, they added MMDAs (Money Market Deposit Accounts at banks) to M1 which really is a step toward M2 which would include other forms of savings accounts. In a sense NewM1 is M2 light. Their idea is one reason we used M2 instead of M1 for post 1983 regressions. Another reason was that Wang used M2. But he extended the idea further. Wang notes that M2 is the major liability of depository institutions. They offset loans on the asset side. So, he says that money is not only represented by deposits (on the liability side of the balance sheet) but also by loans (on the asset side). He then extends the idea to real estate. From personal usage we have two other ideas: credit cards or more specifically card limits, and home equity loans (as someone once said using your home like a piggy bank).

If any of these proposed versions or additions to the conventional money stock are going to bring back pre-1983 behavior we can detect it with regressions. But it is perhaps easier to make graphs of these variables analogous to Graphs 1 and 2. It should be easy to tell positive or negative relations especially during the last 3 recessions. See Graphs 4a and 4b.

ALTERNATIVE MEASURES OF THE MONEY STOCK

M1 and M2 were losing their high positive correlation with economic variables (Lucas and Nicolini, 2015; Wang, 2017). They suggested new definitions of money and added market deposit accounts (MMDAs) to M1 creating "New M1". New M1 is essentially M2 light and we have already shown that M2 has had a strong negative correlation in the last 3 recessions. Wang took a broader approach. He noted that deposits already in M2 formed the bulk of the right side (liabilities and capital) of the balance sheet of commercial banks. Since balance sheets balance, he went to the asset side and suggested that loans, and particularly real estate loans could be a measure of the money stock. Picking up on that idea we thought that another measure would be M2 plus credit extended for home equity loans and on credit cards. Another measure bringing in the overall influence of the Fed and its various programs would be the size of the Fed's balance sheet made somewhat famous by "taper tantrums" in financial markets as the Fed attempted to reduce its size.

None of these modifications restored the pre-1984 positive correlation with GDP. The reason is clear going back to Graph 2 showing GDP vs M2 over the last 3 recessions. M2 is embedded in all of these modifications. The rescue operations of M2 up as the economy dropped (negative correlation) are so strong that they dominate all of these modifications. The magnitude of the rescue efforts in Graph 4a of the Fed's balance sheet is particularly striking (FRED balance sheet data goes back only to 2002). Table 4a shows negative regression coefficients for the last three recessions in subcomponents and overall (1992-2002 numbers come from individual issues of the Federal Reserve Bulletin).

Our interpretation of Wang's idea using the Total Assets of Commercial Banks (TACB) yields an interesting result but has a control problem. Graph 5b and Table 4b show that there is a positive relation throughout the 2000-1 dot.com recession cycle. This recession was very mild, if it was a planet it would be Pluto which has been reclassified as a dwarf planet. The Great Recession cycle as a whole is positive at the 2% level but the adjusted R2 is only .1289. The graph shows an apparent relation between GDP and TACB during the recession stage but one thing is very wrong. Rather than leading the economy down TADI lags the downturn in the economy, a case of apparent reverse causation. Accordingly, the recession regression is negative. The 2020 analysis is simple with the recession regression's negativity overpowering the weak positive relation in the run up subperiod.

The control problem is: how does the Fed control the aggregated size of depository institutions? The Fed can control its own balance sheet (except when the financial markets scream bloody murder in a taper tantrum). It is another thing to control the balance sheets of endogenous institutions. Note: a modification would be to try the liabilities of depository institutions plus the currency component of M1. We both consider our credit cards to be money up to the limit allowed by the credit card company (Visa, American Express, MasterCard, etc.).

M2 is currency held by the public plus checking accounts plus various savings accounts (including MMDAs) plus retail money market mutual funds. But we also use credit cards and there are a number of comments on the web about using home equity loans as a piggy bank. There are two relevant series of home equity loans on FRED: Revolving Home Equity Loans, All Commercial Banks, and Total Home Equity Lines of Credit. Credit card debt is on FRED as REVOLSL, Total Revolving Credit Owned and Securitized. We think the best measure of "moneyness" of credit cards (but not debit cards) and home equity would be the credit limits extended but such data while available for home equity loans are not available for credit card limits. Accordingly, we use the actual loan amounts extended assuming proportionality. Adding REVOLSL and Home Equity loans to M2 creates what we call M6 (M3 and M4 have been used by others). Again, Regressions are run as GDP vs M6 for the last three recession cycles. 8 of the 9 are negative with only the run up to the 2000-1 recession positive.

Summary

Due to exogenous events and the responses of the Fed to rescue the economy from the effects of those events, money, however defined, has lost its close relationship with GDP. But this does not mean that monetary policy is irrelevant. Rather, there has been a shift from controlling money to controlling interest rates. Now we turn to the management of interest rates.

A BRIEF OVERVIEW OF INTEREST RATE MANAGEMENT

What do 1939-41, 2009-16, and 2020 (so far) have in common? Short term interest rates at the zero bound (ZB), huge excess reserves in the banking system, and modest inflation or even deflation. Japan has run into this situation also. The past may contain some lessons for the future.

After the 1937-8 Recession (which was more severe than the "Great Recession" of 2008-9) short term interest rates, namely the 3-month Treasury Bill rate (i3mo), fell to near zero, the ZB. Due to the high excess reserves at the commercial banks there was no need for interbank borrowing and the Federal Funds rate (iFF) had fallen into disuse and would not be revived until 1954. In April 1942, as a result of formally entering WWII, the Treasury "asked" the Fed to fix the 3-month bill (i3mo) at .375% and the 10-year bond (i10yr) at 2.5%. To maintain these fixed yields the Fed would buy bills with legal tender (raising their price and lowering yield) if the market rate tried to go above .375% or sell in the opposite case. The consequence of buying bills and bonds was that currency in circulation and the money stock (which includes bank deposits) increased rapidly leading to inflation and then wartime price controls. In July, 1947, the i3mo was freed and in March 1951 an "Accord" between the Fed and Treasury semi freed the 10-year rate (the Treasury would jawbone the Fed to keep the 10-year rate low especially during Treasury rollovers and new financing).

The Fed has to be secretive about its operations so that people cannot benefit from inside information. But, in 1955, Fed Chairman William McChesney Martin gave a general outline of his operating procedure with his "punch bowl" analogy (When the party gets going, take the punch bowl away) meaning that when the economy is booming and inflation rising, interest rates should be raised to cool off spending (or cut back on money growth); and lower rates and expand money in recessions. This has also been described as "leaning against the wind". The punchbowl theory appeared in December, 2015 and again in December, 2016 as the Fed raised iFF in preemptive moves against a potential inflation.

What went wrong is that as the Great Inflation of 1965-82 gathered steam, Martin did not have the will to carry out the punchbowl plan. A mild attempt to restrain the economy was made in 1966 (opposed by President Lyndon Johnson with a famous meeting at the Johnson Texas ranch) and abandoned with fears of increasing unemployment. Another half-hearted attempt was made in 1969. Martin was not reappointed by Nixon and was, replaced by Arthur Burns who fumbled another attempt in 1974-5. By 1979 inflation was in double digits and in August President Carter appointed Paul Volcker as the head of the Fed.

Volcker's solution involved a bit of deception. He realized that beating inflation would require astronomical interest rates like 20% and that the public and politicians would scream bloody murder. So, he switched operations to restricting growth of reserves and the money stock and claimed that the Fed was just stopping inflationary money growth and that it was the market that should be blamed for the high interest rates, not the Fed. See Meltzer p. 1025 footnote. Mistakes were made but after the two recessions of 1980 and 1981-2 the inflation problem was solved.

But, now there was another problem. The revolution in financial innovation caused by inflation and distortions in funds caused by the interest rate ceilings of Regulation Q led to the invention of money market mutual funds, NOWs (negotiable orders of withdrawal, ATS (automatic transfer service), and money market deposit accounts from the1982 Garn-St. Germain Act, Money was measured as M1, M1+ {, M1a, M1b, and MZM. With these developments the Fed did not know how to measure money. See Meltzer p. 1117. It gave up on October 5, 1982 and went back to interest rate control of short-term rates, particularly the Fed Funds rate iFF. This system held until October 6, 2008.

THE INTEREST ON RESERVES (IOR) PROCEDURE OF OCTOBER 2008

IOR

The original idea of paying interest on commercial bank reserves (Friedman,1960) was then promoted (Goodfriend, 2002). IOR was scheduled to be implemented in 2011 but due to the severity of the Great Recession and financial panic of September, 2008, it was included in the Economic Stabilization Act of October 3, 2008. The Fed began paying interest on reserves 3 days later.

Another major component of monetary reform is QE. The procedure of open market operations involved buying Treasury Bills from banks and the public and paying with legal tender or electronic equivalent-exchanging cash for T-Bills. This was the traditional "Bills Only" procedure of the Fed. In 1961 the Fed bought and sold long term Treasuries in an effort to influence long term rates. This was known as "Operation Twist". It did not work particularly well. In the Great Recession the Fed put a lot of cash or base money by expanding its purchases of not only bills and bonds but U.S. Agency bonds and mortgage backed securities (MBS, WSHOMCB on FRED). These extraordinary purchases are known as Quantitative Easing. On March 23, 2020 the Fed extended QE to the purchase of investment grade corporate bonds due to the emergency caused by the Corona virus. The Fed made some strange purchases. A CNBC commentator said, "I didn't know that Starbucks needed emergency help" with some sarcasm.

The new policies of IOR and QE had a major influence on several economic variables. Andersen and Jordan had a significant GDP - Ba (monetary base) regression 19522Q68. Graph 5a continues plots of Ba and GDP out to 2020. Huge gyrations occurred in 2008 and after as the Fed pumped money into the economy. It is clear that a significant correlation of this kind no longer exists. Graph 5b shows what happened to reserves. The blue line is total reserves and the red line required reserves. The difference is excess reserves, bank cash kept for cashing checks and making loans. Before 2008 banks tried to keep excess reserves to a bare minimum because they earned no interest. But when IOR was adopted in 2008 excess reserves zoomed.

Graph 5c shows what happened to short term interest rates; the Fed Funds Rate, the IOR rate and i3mo. Within arbitrage limits the rates are closely linked. For example, if iFF is too high, banks can sell T-bills (held as a secondary reserve) instead. Also, there are "repos" and "reverse repos" which are overnight loans that are unwound the next day. The Federal Reserve Bank of St Louis has an informative article describing the new procedure in detail (Ihrig & Wolla, 2020).

Something not seen since the end of the Great Depression 1938-41 and before happened from late 2008 to late 2015. Graph 5c shows that the short-term rates went to near zero, the zero bound (ZB). They rebounded a bit but are back to the ZB in 2020. Normally, nominal interest rates should not go below zero or at least the storage rate on a safety deposit box. This is important because at the ZB the Fed loses one of its most powerful tools, the ability to lower interest rates to stimulate the economy. Graph 5d shows bank reserves and the T Bill rate 1929-41. Graphs 5e and 5f show similar situations in Japan 1999-2016. It is possible that these graphs are signs of something called a liquidity trap. In the next section we look at the empirical relation between GDP and iFF.

Tables 4a, 4b, 4c in the Appendix relate GDP to three alternative measures of the money stock to find out if the old pre 1984 positive relation can be restored. The answer is no. It should not be a surprise. The rescue efforts of 2008-9 to combat the Great Recession and of 2020 to combat the economic crash of the virus are so strongly negative that they overpower the rest of the 1992-2020 period.

The Fed readopted interest rate management on Oct 5, 1982 (see Meltzer p. 1117 for why). The Fed Funds rate iFF became the main monetary policy tool. Plots of GDP vs iFF show that the iFF lags the economy with one exception. This is consistent with Martin's famous "Punchbowl" idea, or "leaning against the wind". Raise the iFF in booms and lower it in recessions. This also is consistent with being "data dependent". By the way, rescue operations such as 2008-9 and 2020 is consistent with the Fed's original mission of being the lender of last resort.

But there was another big change on Oct 6, 2008 when the Fed started IOER as a new financial control system. We have the basic St Louis Fed articles you got explaining the system. We don't have to write about that since we can use these articles as references. More regressions 2008-2020. Now the story gets more interesting because we hit the Zero Interest Rate Bound ZIRB from 2009-2016. And back to the ZIRB in 2020. What are the consequences of ZIRB? As empirical analysts we look at ZIRB data. Periods to look at are: USA 2009-2016, 2020, and the end of the Great Depression 1938-1940.

GDP AND iFF REGRESSIONS AND REVERSE CAUSATION

In the first section of the paper, we presented graphs and regression tables of GDP and money. Here we do the same for GDP and the Federal Funds rate iFF. Paul Volcker used money control from October 1979 to October 1982 to defeat the Great Inflation loans was inactive in the 1930s and 1940s because the huge level of excess reserves made overnight interbank borrowing unnecessary. It revived in 1954. Graph 6a covers the GDP and iFF year over year (yoy)

to 1968, a period that Andersen and Jordan could have studied had they so wished. A striking feature is the apparent lag. It looks like the Fed Funds rate lags the economy. As opposed to money which apparently leads the economy. Graph 6b carries the plots out to 1984.

In the 1950s McChesney Martin of the Fed mentioned the "punchbowl" and "leaning against the wind" methods of managing monetary policy. When the economy boomed it was time to raise interest rates (and/or slow the growth rate of money) to slow the economy, or if the economy was declining lower interest rates to stimulate it. Around 2014-5 under Janet Yellen another phrase became popular "data dependent". If we wait a bit for data to confirm a trend this introduces a lag. So that can explain why the Fed's interest rate actions lag the economy. There was an interesting variant on December 16, 2015. iFF was raised in anticipation of an inflation. They jumped the gun because the inflation did not appear.

Reverse Causation. Normally we expect the economy to follow a monetary action of the Fed (and also fiscal policy). When the St. Louis Fed Andersen-Jordan result came out in November 1968 showing that money had a stronger effect on the economy than fiscal policy, Keynesian economists said that money was not causing the f(iFF-1) and iFF = g(GDP-1). The regression results for 1956 to 3Q2020 are in Table 5**.** Money wasn't causing the economy but rather the economy was causing money. Tests of causation and reverse causation to help settle the controversy (Granger & Sims,1972). There are various versions but the graphical appearance is so evident that we use a simplified Sims test. See (8). Normally the economy would be a function of the contemporaneous and lagged monetary variable. Such a function would be GDP = f (iFF, iFF-1). The reverse causation function would be iFF = g (GDP, GDP-1). Or even more simply GDP =g iFF.

In Table 5, there are 9 pairs of regressions, the normal function GDP = f(iFF-1) and the reverse iFF =g(GDP-1). Let us look at the first pair in detail. The "normal" regression of GDP on lagged (by 1 quarter) iFF has an R2 of .0813, R2adjusted of .0459, and a p-value of .14150. The linear regression coefficient is .6410 with a t-statistic of 1.52. It is a weak result. The reverse function is very strong with a .6689 R2adjusted, significance of 6.51e-8 (or .0000000651) and a t of 7.45. It indicates that iFF is a function of GDP rather than GDP being a function of iFF, consistent with the lag of data dependency. The coefficient signs are positive, consistent with punchbowl and leaning against the wind theory. 1956-1962 covers two recession cycles (1957-8 and 1960-1). We double up to condense the table.

Pairs 2 and 3 cover the remaining pre-1985 recessions: the weak 1966-7 mini-recession and the weak 1969-70 recession, then the 1980 and 1981-2 Volcker recessions. Pair 4 covers the Kuwait Oil Crisis 1990-1 recession plus the 2000-1 dot.com recession. All support the reverse causation hypothesis. Pair 4 is significant because Lucas-Nicolini and Wang have mentioned that post the mid1980s monetary variables seem to have lost their influence.

But there is some trouble ahead. Leaving that to the end of this section we now analyze each post 1984 recession cycle. Pair 5 looks at the Kuwait cycle. Pair 6 at the dot.com cycle. No problem, reverse still holds. Pair 7 skips the Great Recession cycle where the trouble is and goes to the Covid Recession cycle. Again, the normal function is insignificant and the reverse function very significant. The problem occurs in the Great Recession itself. First, when did the Great Recession start? The NBER says December 2007, but the decline then was very mild. The real action started with the Treasury rescue of Fannie Mae and Freddie Mac in September 2008. So, we consider that the recession started in 3Q2008. Accordingly, we did Pair 8 from 2003 to 2Q2008 to find out what happened in the pre-recession phase. Again, the normal regression was insignificant and the reverse function significant at the .01 level. But when the missing quarters 3q2008 to 4Q2009 are added in Pair 9, the normal function becomes more significant than the reverse function. It is the only inconsistency in the table.

One of the problems causing the aberrant behavior of 3Q2008-4Q09 is that in December 2008 the Fed Funds rate essentially hit the zero bound barrier. If the zero bound did not exist then the Fed could have let iFF sink into negative territory and maintained the behavior of the other cycles. The second problem is that using year over year data to smooth the data as done by Wang and Lucas-Nicolini means that the iFF change in our yoy data series does not go to zero immediately but takes a whole year for the yoy effect to disappear. Example: if we used monthly differences the iFF change would go to zero in January 2009 since the zero bound was reached in December 2008. But our yoy series does not go to zero until 1Q2010. Using smoothing techniques when encountering a discontinuity causes a problem. This brings up another question. What is the impact on monetary policy when we reach the zero bound?

CONCLUSION

This paper is not the end of our investigation of monetary policy. We have not considered the problem of inflation and how it relates to monetary policy. Curiously we have a problem opposite of that faced by Paul Volcker. Why haven't we been able to get the inflation rate up to the Fed's target of 2% annually? Another question is why didn't QE2 and QE3 get economic growth above 3% consistently? We have mentioned Japan, the U.S. and the zero-bound problem. Tying these factors, the Fisher inflation effect, and the Taylor rule made for an interesting theory of low real economic growth (Bullard, 2020). Much remains to be done.

REFERENCES

Andersen, L. C., & Jordan**,** J. L., (1968**).** Monetary and fiscal actions: A test of their relative importance in economic stabilization**.** *St. Louis Federal Reserve Review, 50,* 11-23.

Lucas, R. E., & Nicolini, J.P., (2015). On the stability of money demand. *Journal of Monetary Economics*, *73*, 48-65.

Wang, X., (2017). *The quantity theory of money*: *An empirical and quantitative reassessment,* Seattle: Washington University Press.

Meltzer, A., (2014). *A history of the federal reserve, volume 2, book 2*. Chicago: University of Chicago Press, 1970-1986.

Friedman, M., (1960). S*tudies in the quantity theory of money*. New York: Fordham University Press.Goodfriend, Marvin, (2002). Interest on reserves and monetary policy, *Economic Policy Review, Federal Reserve Bank of New York, 8*, 77-84.

Ihrig, J., & Wolla, S., (2020). The fed's new monetary policy tools, *St. Louis Federal Reserve Bulletin, August*, 1-11.

Granger, C. & Sims, C., (1972). Money, income, and causality. *American Economic Review 62*(4), 540-552.

Bullard, J., (2010). Seven faces of the peril**,** *Federal Reserve Bank of St. Louis Review 92*, 6.

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APPENDIX

Table 1 .

Recession Estimates

	R2	ADJR2	P-val	Coeffic	t	Variable	n
1957-8	0.8788	0.8615	0.00019	2.577	7.13	M1-1	9
1960-1	0.7346	0.7014	0.00153	1.188	4.71	M1-1	10
1969-70	0.8478	0.8278	0.00016	0.7944	6.68	M1-1	10
1974-5	0.7565	0.7343	0.00011	2.17	5.85	M1-1	13
1980-2	0.7684	0.753	3.91 e-6	1.074	7.06	M1-1	17

Table 2

Recession Regression1990-2020

	R2	ADJR2	P-val	Coeffic	t	Variable	n
1990-1	0.0883	-0.013	0.3749	0.4015	0.93	M2	11
2000-1	0.8431	0.817	0.00128	-6372	-5.68	M2	8
2008-9	0.9303	0.9216	6.68E-06	-0.9076	-10.33	M2	10
2020-0	0.976	0.968	0.00199	-0.7285	-11.05	M2	5

Table 3a

dot.com (2000-1), Great (2008-9), and Covid (2020) Recession Cycles

Dot Com Cycle	R2	ADJR2	P-val	Coeffic	t
Whole4q92-3q02	0.0289	0.0034	0.294	-0.0302	-1.06
PreRecess7q92-3q00	0.3744	0.3535	0.0002	0.2082	4.24
Recess4q00-3q02	0.8431	0.817	0.00128	-0.6372	-5.63
	0.2169	0.1963	0.00246	0.2605	0.32
Great Recession					
Whole2q10-2q20	0.464	0.4456	2.46E-05	-0.8628	-5.01
PreRecess2q10-2q19	0.3003	0.267	0.00678	-0.4844	-3.00
Recess3q19-2q20	0.9505	0.9423	3.85E-05	-8147	-10.74
	0.0982	0.0671	0.08613	0.4036	1.78
Covid					
Whole2q10-2q20	0.6448	0.636	1.57E-10	-0.516	-8.52
PreRecess2q10-2q19	0.1332	0.1091	0.02427	-0.129	-12.86
Recess3q19-2q20	0.9881	0.9821	0.00599	-0.764	-12.86
	0.4778	0.4647	7.03E-07	0.3819	6.05

Notes:
counter intuitive signs in red.

Table 3b

dot.com (2000-1), Great (2008-9), and Covid (2020) Recession Cycles

53-54 cycle	R2	ADJR2	P-val	Coeffic	t
ALL 50-54	0.306	0.2674	0.01141	1.418M	2.82
PRE 50-2q53	0.004	-0.0765	0.944	.0432M	0.07
REC3q53-54	0.8344	0.7792	0.0317	2.837M	3.89
57-58 cycle					
ALL 55-58	0.8903	0.8824	4.228-8	2.334M	10.66
PRE 55-3q57	0.8219	0.8019	0.00012	1.980M	6.44
REC 4q57-4q58	0.9017	0.869	0.01348	2.470M	5.25
60-61 cycle					
ALL 4q58-1q61	0.5149	0.4664	0.0086	1.035M2	3.26
PRE 4q58-1q60	0.0666	-0.1667	0.6214	.3265M2	0.53
REC 1q60-1q61	0.7886	0.7181	0.04421	.8903M2	3.35
66-67 MiniRecess					
ALL2q61-4q67	0.2367	0.2062	0.01007	.7389M	2.78
PRE 2q61-2q66	0.4322	0.4023	0.0012	1.0190M	3.8
REC 2q66-4q67	0.5669	0.4586	0.08404	.6724M	2.29
69-70 cycle					
ALL1968-4q70	0.7388	0.715	0.00014	,985m	5.58
PRE4q69-4q70	0.0835	-0.0693	0.4877	.385m	0.74
REC4q69-4q70	0.7461	0.6615	0.05911	.822m	2.94
1974-75 Cycle					
ALL1971-1975	0.7064	0.6909	1.85 e-6	1.903m	6.76
PRE1971-1973	0.2273	0.0985	0.2323	.823m	1.33
REC 1q74-4q75	0.7571	0.735	0.00011	2.168m	5.85
1980-1982 cycle	……				
ALL1976-3q83	0.1531	0.1239	0.02949	.6713M	2.29
PRE1976-2q79	0.0153	0.1239	0.02949	.6713M	0.43
REC3q79-3q83	0.7682	0.7527	3.94 e-6	1.0740M	7.05

Table 4a

GDP vs Federal Reserve Total Assets Regressions (yoy) ***(YOY)***

dot.com (2000-1), Great (2008-9), and Covid (2020) Recession Cycles

	R2	Adj	p-val	Coeffic	t
2000-1 Recovery	.0003	-.0333	.97520	-.0020	(-.03)
2000-1 Recession	. 4024	.3170	.06653	.2929	(2.17)
2000-1 Combined	.0097	-.0164	.54630	-.0540	(-.61)

2008-9	Recovery	.0489	.0109	.26760	-.1055	(-1.13)
2008-9	Recession	.8552	.8311	.00101	-.0378	(-5.95)
2008-9	Combined	.7334	.7250	1.05e-10	-.047	(-9.38)
2020	Recovery	.0150	-.0131	.46970	-.0068	(-.73)
2020	Recession	7129	.6170	.07203	-.088	(-2.73)
2020	Combined	.4887	. 4750	3.78e-7	-.0723	(-6.10)

Table 4b

GDP vs Depository Institutions Total Assets Regressions (YOY)
dot.com (2000-1), Great (2008-9), and Covid (2020) Recession Cycles

		R2	Adj	p-value	Coeffic	t
2000-1	Recovery	.3058	.2894	.00085	.1856	(3.70)
2000-1	Recession	.7185	.6715	.00786	.6737	(3.91)
2000-1	Combined	.0517	.0267	.15830	.1244	(1.44)
2008-9	Recovery	.0288	-.0101	.39740	.1115	(0.86)
2008-9	Recession	.1656	.0266	.31700	.1893	(-1.09)
2008-9	Combined	.1553	.1289	.02111	.2133	(2.43)
2020	Recovery	.0110	.0110	.52550	.1339	(1.22)
2020	Recession	. 8219	.8219	.09343	1893	(-1.09)
2020	Combined	.4176	.4176	3.79e-6	.2146	(2.46)

Table 4c

GDP vs M6 Regressions
(YOY)
2000-1 dot.com, 2008-9 Great, 2020 Covid Cycles

		R2	Adj	p-value..	Coeffic	t
2000-1	Recovery	.3845	.2597	.00171	.2118	(3.45)
2000-1	Recession	.8688	.8501	.00025	-.8503	(-6.81)
2000-1	Combined	.0487	.0236	.17140	-.1192	(-1.39)
2008-9	Recovery	.1166	.0782	.09475	-.3689	(-1.74)
2008-9	Recession	.8878	.8691	.00046	-.7188	(-6.89)
2008-9	Combined	.1668	.1391	.02029	-.4951	(-2.45)
2020	Recovery	.1197	.0946	.03592	-.1534	(-2.18)
2020	Recession	.6741	.5655	.08839	-.5232	(-2.49)
2020	Combined	.6627	.6541	9.62e-11	-.4830	(-8.75)

Table 5

Normal and Reverse Causation Regressions (YOY)

		Q=f(iFF lag) is normal		***iFF= f(Qlag) is reverse***	
Period	R2	ADJR2	P-val	Coeffic	t
(1) 1956-62-Normal	0.0813	. 0.0459	0.1415	0.641	1.52
(1) 1956-62-Reverse	0.6812	0.6689	6.51E-08	0.3844	7.45
(2) 1962-71-Normal	0.0136	-0.0154	0.4977	0.145	0.69
(2) 1962-71-Reverse	0.2912	0.2703	0.00068	0.4368	3.74
(3) 1972-84-Normal	0.0057	-0.0414	0.5934	0.0739	0.04
(3) 1972-84-Reverse	0.2418	0.233	0.00017	0.5121	4.06
(4 1985-02-Normal	0.1402	0.1279	0.00119	0.3375	3.38
(4) 1956-62-Reverse	0.3408	0.3313	7.36E-08	0.6385	6.02
Cycle					
(5) 1985-92-Normal:Kuiwait	0.0921	0.0619	0.09124	0.2883	1.74
(5 1985-22-Reverse	0.2282	0.2025	0.00569	0.4889	2.98
\					
(6) 1993-022-Normal:dot.com	0.1411	0.1191	0.01551	0.3224	2.43
(6) 1993-02-Reverse	0.4321	0.4175	7.03E-06	7.57E-01	8.45
(7)2010-3Q20-Normal:Covid	0.0445	0.0212	0.1744	0.5676	1.38
(7)2010-3Q20-Reverse	0.387	0.3721	8.45E-06	2134	5.09
(8) 03-2Q08-Normal:PreGrtRecess	0.0488	0.0013	0.3238	0.1862	1.01
(8) 03-2Q08-Reverse	0.3078	0.2732	0.00736	0.8245	2.98
(9) 03-09-Normal:Grt Recess	0.5623	5.45E-01	4.38E-06	6.00E-01	5.78
(9) 03-09-Reversel:Grt Recess	0.3744	0.3503	0.00054	0.416	3.95

Note.

1. Only (9) 03-09-Reversel:Great Recession is counter intuitive

Table 6

Reverse Causation

	Q=f(iFF lag)	***Fed leading the economy***				
	R2	adjR2	p-val	coefficiFF	t	
dot com cycle 1992-2002	0.1246	0.1032	0.02025	0.2826	2.42	
Pre recession 1992-	0.009	-0.0202	0.5822	-0.0632	-0.55	
dot com recession 2003	0.3203	0.207	0.1437	0.2424	1.68	
Great Recession 2003	0.5571	0.5419	0.00000143	0.8843	6.04	
Pre Recession 2003	0.067	0.0226	0.2329	0.2049	1.23	
Great recession	0.7137	0.6778	0.00415	1.316	4.18	
Covid cycle3Q10-2Q20	0.3287	,3111	0.00011	2.707	4.31	inconclusive
Pre Recession 3Q10	0.0331	0.0047	0.2882	0.3782	1.08	
Covid Recession -2Q10	0.686	0.5813	0.0832	4.641	2.56	
	iFF= f(Qlag)= Fed following the economy					
	R2	adjR2	p-val	coeffic-Iff	t	
Pre recession -1992	0.4468	0.4333	0.000000966	0.7961	5.75	
Dot com recession -2002	0.1067	0.0804	0.05188	0.4119	2.02	
	0.9283	0.9164	0.00012	1.355	8.82	
Great Recession 2003						
Pre Recession 2003	0.4408	0.3802	0.0013	0.5291	1.075	
Great recession	0.3192	0.2868	0.00497	0.8414	3.14	
	0.0002	-0.1426	0.969	-0.0129	-0.04	
Covid Cycle 3Q10-2Q20						
Pre Recession 3Q10-	0.1903	0.169	0.00489	0.3356	2.99	inconclusive
Covid Recession 2Q20	0.0663	0.0389	0.1294	0.1257	1.55	
	0.571	0.428	0.1396	1.075	2	

Notes

1. Why didn't OE2 stimulate the economy?
2. Why can't we increase inflation?
3. What about inflation regressions?

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EXPLORING RESEARCH TRENDS IN COMPUTING USING THE ACM COMPUTING CLASSIFICATION SYSTEM

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ABSTRACT

Exploring research trends in technology through the use of a controlled indexing vocabulary within a substantial dataset associated with a significant computing science corpus is of interest as it allows one to see the patterns of research within the computing sciences pursued and published over time. When the exploration is performed via various visualizations, both static and dynamic, it allows for a more holistic analysis, particularly over protracted periods.

This paper analyzes the patterns of research that have been published within the Association for Computing Machinery's (ACM) digital library (DL), a significant computing science *corpus*, from the years 1951 until 2017, a protracted period. The number of documents analyzed within that time frame was 448,249, representing a substantial dataset. The patterns of research are explored via the use of the ACM's controlled indexing vocabulary, the Computing Classification System (CCS). The number of CCS terms extracted from the documents was 1,075,197.

The analysis was performed using both static and dynamic visualization. The exploration suggests three interesting trends that have occurred in the science over the time studied, as well as suggesting some topics that perhaps demand more focus. Of note, there has been a significant diminution in the mathematical aspects of the science, with a recent uptick in interest for the human-centered components of the field. A lack of research in security and privacy is also suggested.

INTRODUCTION

The Association for Computing Machinery (ACM) "the world's largest educational and scientific computing society, delivers resources that advance computing as a science and a profession. ACM provides the computing field's premier Digital Library and serves its members and the computing profession with leading-edge publications, conferences, and career resources" (ACM, 2020). The ACM provides access to the metadata of documents in the digital library for research purposes on application. We acquired the metadata, which covers the years 1951 through 2017. During that time, several schemes were used to classify documents among computing-related topics. Fortunately, the staff of the ACM DL undertook the task of reclassifying all the documents in the collection according to the 2012 Computing Classification Scheme (ACM CCS). This provides a very large corpus of documents with a common controlled vocabulary used for categorization and allows for a significant review of the changing nature of the computing discipline over its relatively short history.

We extracted the CCS codes from all the documents in the collection. In order to have a mechanism for comparing the CCS codes used in the papers to the actual CCS scheme, we created a flat file version of the CCS. Each line in our flat file contains a possible CCS encoding. That includes each of the 13 root nodes alone, and each possible path at every possible length. The possible paths starting at "Computer systems organization" and ending at or before "Reduced instruction set computing" serve as an example of the flat file entries:

Computer systems organization
Computer systems organization| Architectures
Computer systems organization| Architectures| Serial architectures
Computer systems organization| Architectures| Serial architectures| Reduced instruction set computing

We produced these representations for every possible path in the CCS and used these to match against the CCS codes in every paper in the collection.

The paper is organized as follows: Previous Research describes somewhat related work. The Methodology Section describes the data used, including some issues with the data that required wrangling. The Results Section provides detailed results of the work. Finally, Conclusions and Future Work summarizes the results of this phase of the project and introduces some additional questions to be addressed in the future.

PREVIOUS RESEARCH

Some work that precedes this research, particularly that involving visualization, used the 1998 ACM Classification System and was more focused on retrieval (Medina, Sánchez, Mora & Ruiz, 2012). Another paper looked at the title and abstract for classification Zhang, Gonçalves, Fan, Chen, Fox, Calado & Cristo, 2004); this research focuses on the CCS for analysis. Finally, the paper, "Topic Models for Taxonomies," (Bakalov, McCallum, Wallach & Mimno 2012) presents two semi-supervised topic models that automatically discover lists of relevant keywords for taxonomic concepts but did not look at trends.

METHODOLOGY

The goal of the project is to explore the Association for Computing Machinery's (ACM) Computing Classification System (CCS). We obtained the metadata for the ACM Digital Library (ACMDL), which describes 448,249 documents published between 1951 through 2017. The metadata includes the document's unique identifier (ID), the date of the publication, the abstract, the user-supplied keywords, and the CCS. Abstracts, keywords, and CCS were not present for all documents. The data was extracted and parsed from a series of files within multiple folders provided by the ACM. Duplicate documents appeared as a result of a single item appearing in multiple places. Removing 26,204 duplicates left 422,045 unique article records.

Since the publication of ACM CCS 2012, ACM personnel have retrofitted the 2012 classification scheme to the earlier papers in the digital library. This allows exploration of the changing nature of publications over the long history of the computing discipline. Of the 422,045 documents in the collection, 86,203 did not have CCS codes. Eliminating those leaves 335,842 documents for the study.

Some documents had repeated CCS branches, so the repeated branches were removed to eliminate multiple counting. There were 131,265 such documents. The format of the actual CCS was not consistent, so some work was done to ensure that the CCS terms matched those of the full set. (Within the entire CCS full set, there are 2,111 different terms that can be applied.) Some of the CCS elements had the traditional format, such as "CCS->Mathematics of computing->Mathematical software." There were 1,001,340 such terms. Others involved only the root and the leaf of the branch, separated by a tilde (~), such as "Security and privacy~Virtualization and security." There were 73,452 of those terms. (Of note, some of the CCS terms encoded with a "~" had some ambiguity associated with them as some matched to more than one term within the CCS. For example, the terms "Applied computing~Computational genomics" can be matched to both "Applied computing->Life and medical sciences->Genomics->Computational genomics" and

"Applied computing->Life and medical sciences->Computational biology->Computational genomics." For this analysis, the first match was chosen to avoid double counting as we explored only the first two levels.) A third type involved a free-form format, with no regularity, and some had extraneous text. There were 448 such terms. This accounts for 1,075,240 CCS terms matched. Considering all the matches, and then removing other duplicates, there were 1,075,197 records of CCS terms that were analyzed for this study.

As mentioned previously, the CCS was applied throughout the corpus, so it is of interest to know the distribution of the records processed by year with a CCS applied and how many CCS terms were available by year. This is summarized in Table 5 in the Appendix. Of note, there are no CCS terms applied for the Years 1951 or 1953.

As the CCS is a very large hierarchical structure, with some concepts several levels deep (five), only the first two levels were explored for this paper. The first level has 13 branches and the second has 84 different branches. For the first level, the branches below were collapsed to include all subtrees associated with that particular branch. For example, the second-level branches of "Software and its engineering->Software notations and tools" and "Software and its engineering->Software creation and management" are both subsumed under the higher level of "Software and its engineering" and are counted as two instances.

RESULTS

We analyzed the frequency of occurrence of each of the thirteen different first-level categories. Table 1 shows the total frequency by topic, ranked by cumulative frequency over the time period studied (1951 – 2017):

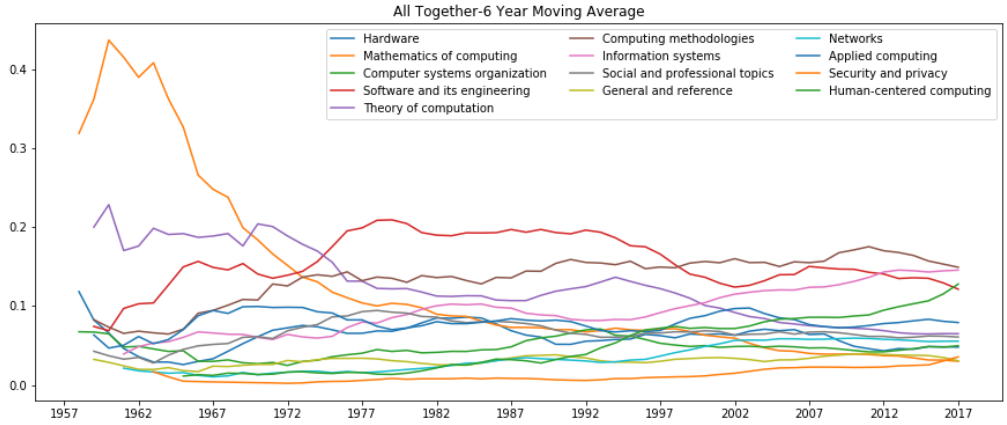
Table 1. Order ranking of First-Level CCS Terms by Cumulative Frequency

CCS Top-Level Term	Frequency
Computing methodologies	169,411
Software and its engineering	153,925
Information systems	133,483
Human-centered computing	95,326
Theory of computation	89,171
Applied computing	85,702
Social and professional topics	69,103
Hardware	58,924
Networks	55,553
Computer systems organization	52,773
Mathematics of computing	50,813
General and reference	37,197
Security and privacy	23,816

While the cumulative sum of the frequency of occurrence is of interest by itself, for example, computing methodologies are the most published type of paper, with security and privacy at the first level being the least published, the patterns of research over time shows how the subfields evolved. The best way to explore these trends is via visualization, as, to paraphrase Cleveland, "visualization reveals intricate structure that cannot be absorbed in any other way" (Cleveland, 1993).

The visualizations chosen are line plots for the first- and second-level analysis and dynamic bar charts for the second level. For the line plots, number of publications within a category are explored, with that number being normalized through the percentage of publication of each topic by year and, because of variable trends, a moving average of six years was computed to show a more robust trend. Figure 1 shows the line graphs of all thirteen categories.

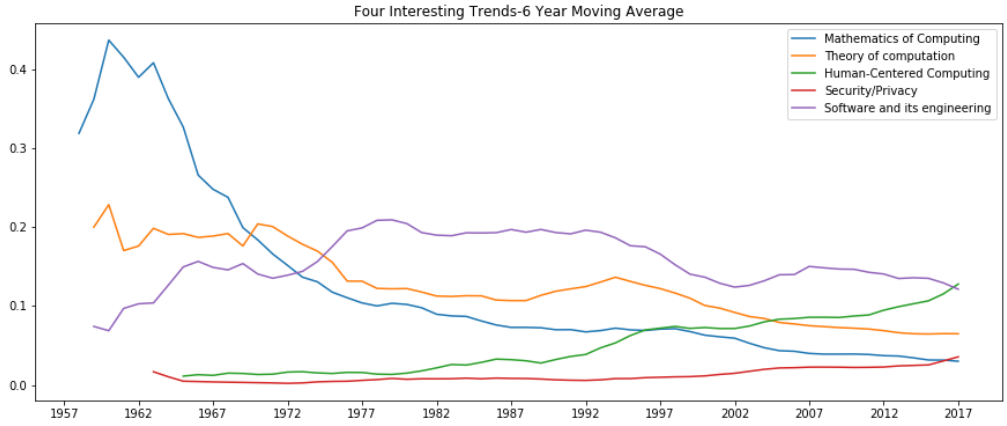
Figure 1. First-Level CSS Term Percent Usage over Time



Most of the categories remained stable over the time frame examined, with Software and Engineering being the most prominent, but four categories stand out for changes in the field; albeit one is stable but also of interest.

Figure 2 shows those five research areas illustrating four interesting changes in the research over time.

Figure 2. Most Significant Changes over Time



One can readily see that interest the mathematics of computing has lessened considerably, from a high of almost 50% of the publications to now less than 10%. This trend is also found within the theory of computation, but to a lesser extent. Software engineering increased for two decades, with a slight diminution after. Interest in the subject of human-centered computing, has increased from almost no interest to more than 10% of the research with a recent uptick and probable trend. Finally, a rather important field, security and privacy, has remained a low priority over the time of the analysis, albeit with a slight increase recently.

The second-level branch frequencies were computed the same way as the first-level ones, i.e., subsuming the lower branches, if they exist. There are 84 level-two such branches in the full tree (the standard tree provided by the ACM) and 84 presented in the analysis. (If only the root branch was present, e.g., "Computing methodologies,' then that term was omitted from the analysis.) The top ten classification terms are listed in Table 2, again rank ordered.

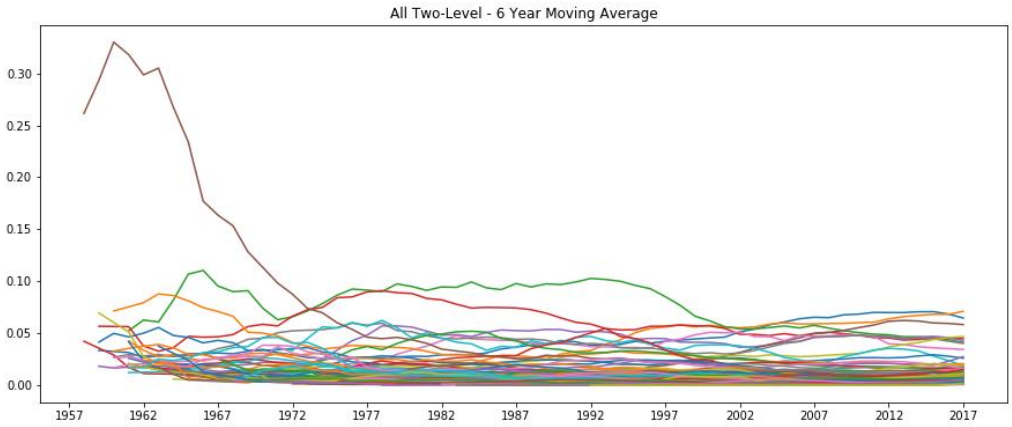
Table 2. Top-Ten Second-Level CCS Terms by Cumulative Frequency

Two-Level CSS Classification	Frequency
Computing methodologies->Artificial intelligence	61,444
Human-centered computing->Human computer interaction (HCI)	60,657
Software and its engineering->Software notations and tools	59,914
Social and professional topics->Professional topics	52,499
Software and its engineering->Software creation and management	46,648
Information systems->Information retrieval	46,306
Computing methodologies->Computer graphics	43,371
Software and its engineering->Software organization and properties	43,264
Information systems->Information systems applications	34,807
Computing methodologies->Modeling and simulation	32,326

One can see that "Computing Methodologies" again dominates, but the second level shows that artificial intelligence was the dominate subcategory and one of the reasons for its top ranking (along with Computer graphics). Following at a close second, human-computer interaction is the main subcategory for the human-centered computing category, which ranked fourth, (Table 1), when combined with the other main (first-level) categories.

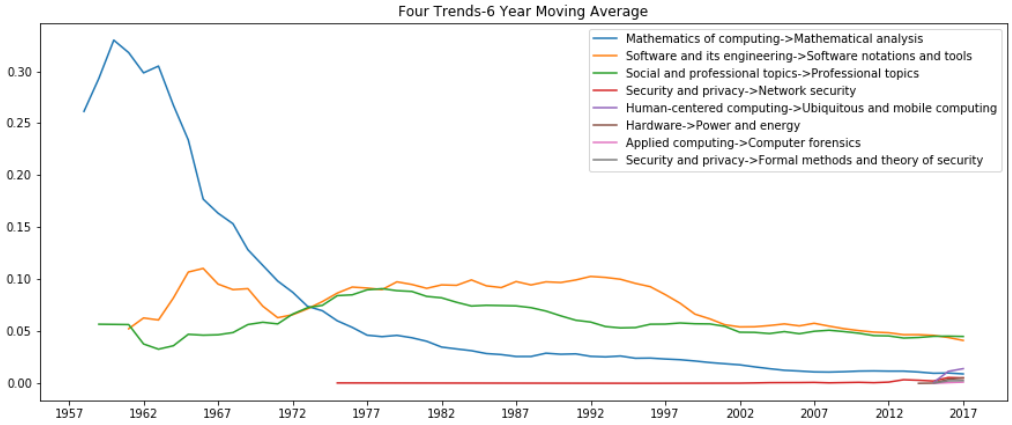
Using line charts, similar to the analysis of the first-level terms, yields somewhat similar results. A graph showing all the second categories is shown in Figure 3. (The legend of the graph was omitted due to the large number (84) of categories).

Figure 3. All Second-Level Subcategories



Again, a great initial interest in Mathematics of Computing->Mathematical Analysis with the interest greatly decreasing over time is reiterated. This is shown in Figure 4.

Figure 4. Significant Second-Level Subcategories



Along with the decrease in interest in mathematical analysis, one can see the bi-modal interest in software engineering (notations and tools) and the subtle spike of professional topics. Network security is noteworthy for its later start in the research. What is also of interest are the very late starts (far right bottom in graph) of several second-level categories. This is shown in Table 3:

Table 3. Frequency of Publication of Recent Topics of Interest by Year

Second-Level Category	2014	2015	2016	2017
Human-centered computing->Ubiquitous and mobile computing	0	38	493	616
Hardware->Power and energy	1	13	168	227
Networks->Network algorithms	0	18	153	210
Security and privacy->Formal methods and theory of security	0	7	104	117
Applied computing->Computer forensics	0	2	29	53

It is also of interest to see how the topics wax and wane over time in terms of popularity. Table 4 lists the top five categories, in terms of frequency of occurrence, from 1961 until 2017 in a snapshot of four years steps:

Table 4. Top-Five Second-Level CCS Terms by Cumulative Frequency over Time

1961	1965	1969
Mathematical analysis	Mathematical analysis	Mathematical analysis
Software notations and tools	Software notations and tools	Formal languages and automata theory
Design and analysis of algorithms	Professional topics	Software organization and properties
Software organization and properties	Design and analysis of algorithms	Software notations and tools
Professional topics	Discrete mathematics	Professional topics
1973	1977	1981
Modeling and simulation	Professional topics	Software notations and tools
Professional topics	Software notations and tools	Professional topics
Software organization and properties	Modeling and simulation	Modeling and simulation
Software notations and tools	Software creation and management	Data management systems
Design and analysis of algorithms	Software organization and properties	Software organization and properties
1985	1989	1993
Software notations and tools	Software notations and tools	Software notations and tools
Professional topics	Software creation and management	Human computer interaction (HCI)
Software creation and management	Professional topics	Professional topics
Data management systems	Architectures	Architectures
Software organization and properties	Software organization and properties	Software creation and management
1997	2001	2005
Computer graphics	Artificial intelligence	Artificial intelligence
Software notations and tools	Human computer interaction (HCI)	Professional topics
Human computer interaction (HCI)	Software notations and tools	Software notations and tools
Professional topics	Modeling and simulation	Software creation and management
Artificial intelligence	Professional topics	Human computer interaction (HCI)
2009	2013	2017
Artificial intelligence	Human computer interaction (HCI)	Human computer interaction (HCI)
Human computer interaction (HCI)	Information retrieval	Information retrieval
Information retrieval	Artificial intelligence	Information systems applications
Computer graphics	Software notations and tools	Artificial intelligence
Modeling and simulation	Information systems applications	Machine learning

While Table 4 shows a snapshot of the research popularity over fifty-seven years, in steps of four years, a full table would also be of interest to show more of the picture, say the top ten topics over the full range of the data available. Such a table would be unwieldy and overwhelming, however. Nonetheless, keeping in the spirit of visualization revealing features that cannot be absorbed in any other way, a dynamic graph, based on (Vardhan, 2019) and presented with (Tsonev, 2014) of this data is available online (http://csc.villanova.edu/~cassel/acmdl/index.html)

CONCLUSION AND FUTURE RESEARCH

In conclusion, the ACM Computing Classification system serves as a controlled vocabulary for identifying the topic content of a published work. Since every ACM publication must have at least one classification, there is a consistent source of identifications for a very large corpus. The work of the ACM staff in retro classifying older publications with the current classification scheme provides a valuable resource for exploring the history of research interests in the computing domain. We have shown trends from the earliest publications through 2017, the last date for which the metadata is available.

There are 13 top-level categories in the CCS. These are naturally broad and provide only a rough description of publication trends. Each of those 13 categories serves as the root of a tree with increasing level of detail as we move to the leaves. With 2,111 different nodes in the tree, the lowest levels are too fine-grained to be useful for detecting trends. In this paper, we limit our analysis to the 84 distinct terms of the second level of the tree.

The analysis shows a heavy focus on mathematical analysis in the early years of computer science publications. The use of that classification diminished over time. That may be due to increased interest in other topic areas but may also be influenced by the attention to theory in a greater variety of topic areas. These can be classified under the topic areas and not as a more generic mathematical analysis. The graphs and tables show the rise and fall of research interests as expressed by their CCS classification.

In terms of extending this research, most publications also include author-chosen keywords. Comparison of the keywords and the CCS terms offers an opportunity to explore how well the authors felt the CCS served to classify their papers. Other ways of exploring the CCS include looking at the structure itself. There are duplicates among the 2,111 nodes. It is worth exploring the different tree branches that lead to the repeated terms and determining if they really represent different concepts because of the context in which they appear or if there is some ambiguity in the classification scheme.

Perhaps of greater interest is to explore what is missing from the data. What nodes in the classification tree are never or are rarely used? Are these topics that just never needed research and publication or are at least some of them calling out for new researchers to step up and explore the topic? For a student searching for an interesting topic, a visual representation of the sparse areas of the publication record could be a valuable aid.

REFERENCES

ACM (2020). https://www.acm.org/

Bakalov, A., McCallum, A., Wallach, H. & Mimno, D.. (2012). Topic models for taxonomies. In *Proceedings of the 12th ACM/IEEE-CS joint conference on Digital Libraries (JCDL '12).* 237–240.

Cleveland, W. (1993). *Visualizing data*. Hobart Press.

Medina, M.A., Sánchez, J.A., de la C. Mora, J. & Ruiz, A.B. (2012). Visualization of records classified with the 1998 ACM CCS. *Proceedings of the 4th Mexican Conference on Human-Computer Interaction (MexIHC '12).* 55–62.

Tsonev, K. (2014). https://github.com/krasimir/gifffer

Vardhan, P. (2019) "Bar Chart Race in Python with Matplotlib" (https://towardsdatascience.com/bar-chart-race-in-python-with-matplotlib-8e687a5c8a41)

Zhang, B., Gonçalves, M.A., Fan, W., Chen, Y., Fox, E.A., Calado, P., & Cristo, M.. (2004). Combining structural and citation-based evidence for text classification. *Proceedings of the thirteenth ACM international conference on Information and knowledge management (CIKM '04).* 162–163.

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APPENDIX

Table 5. Number of CCS Terms Applied to Publications by Year

Year	Counts	Year	Counts	Year	Counts
1951	-	1974	2,455	1997	22,377
1952	87	1975	2,664	1998	27,730
1953	-	1976	3,284	1999	22,063
1954	27	1977	2,818	2000	26,230
1955	51	1978	3,961	2001	25,735
1956	202	1979	2,520	2002	20,572
1957	128	1980	2,948	2003	22,960
1958	70	1981	4,315	2004	25,978
1959	121	1982	3,948	2005	35,523
1960	84	1983	4,389	2006	50,833
1961	581	1984	5,398	2007	39,452
1962	313	1985	6,696	2008	55,036
1963	213	1986	10,862	2009	58,892
1964	816	1987	11,346	2010	52,288
1965	823	1988	13,381	2011	54,752
1966	385	1989	14,743	2012	51,458
1967	860	1990	13,778	2013	52,531
1968	495	1991	13,913	2014	59,023
1969	1,124	1992	15,556	2015	58,823
1970	533	1993	16,644	2016	45,196
1971	1,370	1994	16,193	2017	45,554
1972	1,206	1995	21,432	Total	1,075,197
1973	2,305	1996	17,153		

MODELING SHORT TIME PERIOD CAR REDISTRIBUTION POLICY IN CAR SHARING INDUSTRY

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ABSTRACT

Economic, environmental and social impacts have increased popularity of car sharing program. More firms consider entering this market to satisfy rising demands from public. In general, a car sharing company faces two very practical problems: 1). Station Size/Capacity; 2). Strategies for imbalance of vehicles distribution for each station. Although literature presents that such questions have been studied in the past, almost all of them use optimization models to address these questions; and the problem of those optimization models is these optimization models are specifically question-oriented, therefore it is difficult to be implemented in practice and cannot be easily generalized in common situations. In this study, we develop a novel model to address these questions. Our models require few inputs and offer quick analytic results. An application of the models on Zipcar illustrates how our models work and shows that our models perform well, achieving expectations.

INTRODUCTION

Background Introduction

In United States, Car-sharing programs start from 1994. Compared with traditional car rental industry, car-sharing programs rent vehicles in usual shorter rental time period by hours or actual driven miles. The design of these programs makes themselves very attractive to consumers who make occasional use or short time period use of vehicles. The car-sharing companies select some locations as their stations and deploy vehicles in specified stations for consumers' use. Consumers can make reservations online and pick up vehicles at the scheduled time and return the vehicle either the original station or other companies' permitted stations. Since programs are perfectly designed for short time period users, a reserved parking space, prepaid fuel and vehicles regular insurance are all included in the hourly rental fee. It helps consumers financially not to pay unused time and any other additional fees.

In recent years, along with recognizing positive contributions on environment and society, car-sharing has emerged as an important alternative as public transportation choices, the market of car-sharing expands extremely fast. Barth et al. (2002) depict all kinds of situations that could favor using car-sharing programs to save expenses, time etc. In 2002, Shaheen et al. (2013) reported there were about 16,000 members in North America; in terms of the recent report from Shaheen et al.(2020), Membership of car-sharing has grown exponentially to more than 2 million in the 2018. They reported the vehicles used in car-sharing programs in United States have grown from 696 in 2002 to 15,224 in 2018. And according to Navigant Consulting, the total global revenue for car-sharing industry reached $1 billion in 2013 and is expected to continue growing to $6.2 billion by 2020.

Besides financial help on consumers, car-sharing can also bring significant social benefits, such as reducing air pollution, emissions and traffic jams on the road. According to San Antonio government report(2011), each car-sharing vehicle can take 4.6~20 cars off the road on average a day. This brings a variety of benefits not only for users but also for all other stakeholders. For users, car-sharing reduces traffic on the road, it saves money and time to park shared vehicles in preserved spots instead of finding spaces for self-owned car. For other stakeholders, car-sharing reduces Carbon emission, and thus it is more friendly and sustainable to our environment. Due to the programs providing tremendous environmental and social benefits, Enoch et al. (2006) advocate governments should offer more incentives for car-sharing companies. In recent years, car-sharing has been encouraged by many governments' agencies. Several cities' government in Texas have collaborated with car sharing companies, such as Car2go, to encourage their employees to use car-sharing services as many as possible, they offer free street park on any city-owned street parking spots.

Research Motivation

Zipcar is a US based car-sharing company, and it is the largest car sharing and car club service in the world. It provides an alternative relative to car rental and personal car ownership. The members of Zipcar just need to pay a fixed amount monthly member fee and rental fee based on actual driving hours to Zipcar, everything else like gas, insurance would be included in the hourly rate. The most convenience for Zipcar members is that cars from Zipcar are usually just parked minutes away from some popular public facilities and high-density population area, like universities, hospitals,

downtown, airports etc. So, Zipcar members can easily pick up cars in these popular spots and return them with guaranteed parking spots. This new business style has attracted over millions of members all over the world with more than 15,000 vehicles served in North America and some parts of Europe.

This study is motivated by regular operations from Zipcar. Besides vehicles purchasing and maintenance, in its regular business operations, Zip car primarily faces one major question - Capacity/Size decision: given a selected location, the company needs to make a strategy to decide how many vehicles are needed to be deployed in the station; and what would be the strategies for Zipcar to react imbalance situations of vehicles distribution if that is the case? Sending more vehicles or simply declining surplus demands are decisions that managers need to make. Although these two questions look similar to a traditional operations management issue: capacity issue, due to the uniqueness of car-sharing business, commonly used methodologies that address capacity issue cannot be directly employed in car-sharing business. Since locations of ZipCar stations were selected carefully, the company's regional managers need to deal station size/capacity and how to balance the number of vehicles at different locations when having skewed usage.

Research has been active in studying these problems. However, almost all of these studies fall into using optimization models to solve the problems. In general, optimization models can perfectly answer problems. Such models are difficult to be generalized and very question oriented. At the same time, validating models requires collecting significant amount data. In practice, not all car-sharing companies can have sufficient data that they could analyze. Therefore, a relatively simple and easy to be implemented model is needed, which may serve a better role to provide managerial suggestions and while keeping fewer inputs. Our research takes a few steps in proposing a brand new integral mathematical framework to address resource allocation and redistribution problems in car-sharing industry. We study these tradition problems from a new perspective and our models' settings are different with traditional optimization models. And through our computational study, we showed our models require less information.

Our contributions from this study are primarily as follows: 1). Compared with past models, since most of those models-built integer optimization models, simulations were often used to find optimal solutions for specific questions. Our model provides analytic results that can offer swift decisions on general car-sharing management issues; 2). Our model requires fewer data inputs; and through practical examples, our model predictions achieve expectations; 3). From methodology perspective, we employ differential equations from control theory to set up our models. To best our knowledge, this is the first paper using control theory solve car-sharing management issues. We hope the implications of control theory on car-sharing industry can help managers make better and quick decisions.

The paper organizes the remaining structure as follows. In next section, we will review the literature on all car-sharing business decisions from methodology perspective. Model section introduces the models on vehicle allocations and redistribution; after introducing each model, we solve the models and give solutions of each model. The next section uses Zipcar as an example to illustrate how our models work and what they mean to general car-sharing companies; then, last section summarizes results and business implications and gives future research directions.

LITERATURE REVIEW

Car-sharing business models include the round-trip, one-way and free-float(mobility) three types of rental contracts. Round-trip rental requires users return vehicles to original pick-up places; One-way allows users to return vehicles to any other permitted places; Free floats rental type just emerge recently, which doesn't have any fixed spots for users to pick up vehicles, vehicles could be parked in a certain range area within acceptable walkable distance; users are not required to return the vehicles to a specific station, it could return the vehicles any place in a legal parking area. The research on round-trip type rental is primarily focusing on exploring strategies of offering spatial and temporal customer flexibility to achieve better supply-demand alignment, like Strohle et al(2019). The research on free-float is just emerging and presenting a promising research direction. The free float system has been studied recently. Weikl et al.(2012) developed two decision support systems(simulation) for user-based relocation strategy and operator-based relocation strategy separately. The most recent study on free float system is to use data analytics. Wagner et al. (2015) present a decision support system that derives indicators for the attractiveness of certain areas based on points of interest in their vicinity. Authors employ data mining techniques to develop the whole system and use real city of Berlin data to validate proposed model. Weikl et al.(2015) proposed a low computational optimization model to provide insights for free-float scenario. Currently most of work concentrates on one-way rental, and our research is also falling into this category.

As we state in the previous section, literature on one-way car-sharing mainly tackle one or multiple following problems: 1). What would be the size for one station? 2). How many vehicles should be transferred if vehicle imbalance exists among stations. Barth et al.(1999) use simulations to evaluate vehicles availability, vehicles distribution etc.. They suggest the most effective number of vehicles is about 3-6 vehicles per 100 trips in 24 hours and in order to minimize the number of vehicles relocation, they suggest having 18-24 vehicles per 100 trips. However in practice, having 18-24 vehicles in a few stations creates not only financial difficulty for car-sharing companies to purchase more vehicles, but also parking spots difficulty to find sufficient spaces accommodate all vehicles in high-density population regions.

The optimization models play a center role to address those managerial problems in recent years. Rickenburg et al. (2013) proposes a model to minimize the total costs including station set-up costs, vehicles purchasing costs and parking space costs. They use this optimization model to determine location and size problems for each location. The model was validated by actual data from a city in German. Correia and Antunes (2012) address the issues of number of vehicles of each station. They claim each station readjust the number of vehicles availability each day. The adjustment is on daily basis. The model was built from company's side to maximize profits for the company. However the model cannot handle imbalance situation if it occurs during the day. Similar to Correia and Antunes' work, Jorge et al. (2014) allow the company management dynamically rebalances vehicles at any time of a day. The model is mixed integer linear programming. Authors use simulation to search solutions.

Cepolina and Farina (2012) specifically study relocation problem and build an optimization model that minimize costs of the combination of consumers and companies, subject to the maximal consumers' waiting time. Authors use simulation to solve the model. Kek et al.(2006) build a simulation model together with real commercial data to provide a strategy to relocate imbalance vehicles. The model basically adopts shortest travel time strategy to transfer vehicles from vehicles over-accumulated stations to shortage stations. The shortest travel time is the time of company's staff travel from current places to over-accumulated station plus travel time from over-accumulated station to desired station. Kek et al. (2009) then build an optimization simulation model to revisit problems that they had addressed in 2006. In that study, they minimize shortage time of vehicles, parking space and as well as the number of relocations.

Fan et al. (2008) further construct an optimization model, which allows managers could adjust the number of vehicles on each station on daily basis. A stochastic programming model with simulation method is used to maximize profits for the whole car-sharing system. However, the model requires fleet size, the number of locations and the demand are known beforehand. Cheung et al.(1996) use dynamic program to determine how many vehicles should be assigned at each time periods. Fan et al. (2013) borrow the philosophy from Cheugn's paper and study car-sharing allocation strategy more dynamically, they divide the whole operating time horizon into several periods, operators need to check the status of each station at the end of each period to make decision if vehicles relocation is needed. They use stochastic program in multistage periods to find the strategy of allocating vehicles.

The more recent study on relocation includes Nair et al. (2011) and Shu et al.(2013). In Nair et al. (2011) study, the objective function is to minimize the total redistribution costs given other costs and demands are known. The novel of the proposed model is that authors use chance constraints to model possibilities of vehicles transitions between stations. Shu et al.(2013) develop a decision support system of bicycle in Singapore. They first use available data to estimate demands on daily basis; and then build a linear program to find the optimal number of bicycles should allocated to one particular station. They also build another model to find the highest utilization for all bicycles in order to decide how to redistribute imbalanced bicycles to fulfill the future expected demands. However, it needs to be mentioned that relocating bicycles is much easier than relocating vehicles. From all costs perspective, a bicycle-sharing system is much inexpensive than car-sharing system. Transferring bicycles wouldn't cost company too much; while transferring multiple vehicles at one time, costs are significant higher. The facts force the car-sharing company to make effective strategies even more important.

Smith et al. (2013) consider relocating costs consist of vehicles transfer costs and driver travels costs. They build a model that includes two linear programs to minimize the total costs.

Since vehicles relocation costs are very high if all relocation needs staff and operators supports. In order to reduce such costs for the car-sharing company, instead of traditional operator-based vehicle relocation, Barth et al. (2004) propose user-based vehicles relocation strategy: trip-sharing and trip-splitting. Authors claim that using these two strategies can reduce 40% costs for the car-sharing costs. Ait-Ouahmed et al.(2018) used linear programming model

to provide insights by considering costs and quality of services. Wang et al. (2019) used an integer programing model to provide a vehicle relocation and staff rebalancing plans based probilities.

The literature review revealed that almost all researchers tackle traditional car-sharing questions by using optimization models. Optimization models perform extremely well when questions are very specific, especially input data can be observed. The solutions of optimization models can be very specific and present exact suggestions on those operational issues. However, with such exact comments provided, the limitations are also very clear. A strict model usually lack of flexibility. The most of current research is very question oriented. The model might be extremely fit in one provided data/environments, but on the other hand it could be very difficult to be generalized to other cases; therefore for another situation, researchers need to build another models to find out managerial comments. Another limitation is optimization models used in this area have gradually become more sophisticated and complicated, it leads to simulation become the only tool that can offer meaningful results. While running simulation could be very time-consuming.

In our view, our model proposes a new way to estimate the station's capacity and reveals a new strategy how to decide if a car-sharing company should perform rebalance in a one-way rental. The model provides general policies that could be applied more car-sharing situations rather than constrained by only one or a few situations.

THE MODEL

Deployment and redistribution modeling

Estimating car station size and making vehicle redistribution policy are challenge questions for a management team, a mismatched policy/estimation would create significant loss to the company. Given regardless one-way rental or round-trip rental, redistribution or relocating vehicles would only occur if rental/demand rate is greater than return rate. On the reverse situation, that would be no issues, we consider composite demands, which equal to [Actual Demand – Returned Inflow Vehicles]. In the following discussion, the demand means composite demands rather than actual demand.

We observe car-sharing company provide 24*7 services; therefore, our intention is to employ continuous-time differential equations with stochastic replenishment interval to model the problems. For a given location (also called a car station), we can draw the expected demand of the vehicles and timely vehicles redistribution to satisfy the customers' needs. Particularly, we build a continuous-time deployment and redistribution model on a stochastic dynamic process to address the issues.

Model Description

We use the following notations and assumptions.
Notations:

t_s: The time from the highest vehicles inventory level to zero, it is between two vehicles relocations.

z: The time length determined by the car-sharing company to replenish one station. z is a random variable and has a property of independent identically distributed at any given two vehicles' relocations, its value range is in $[z_1, z_2]$. $[z_1, z_2]$ is determined by the car-sharing company, that gives minimal and maximal time breaks of one car relocation, respectively.

r: Basic demand in unit time, $r \geq 0$. We assume the basic demand for a station is greater than zero. We assume basic demand as regular average demand for a station.

$D(t)$: Composite demand at a station at time t ,which is the actual demand minus returned inflow.

$D(t)$ has the following form:

$$D(t) = \begin{cases} r + \alpha I(t), & I(t) \geq 0 \\ r, & I(t) < 0 \end{cases}$$

$I(t)$: Vehicles inventory level in a certain business station at time t .

α: Inventory level coefficient, average percentage of customers who are willing to wait for next available cars when customers saw the inventory of the station. $0 \leq \alpha \leq 1$

$DS(t)$: Deferred supply rate. When demand is greater than inventory, the car-sharing company can redistribute according vehicles to satisfy consumer's needs. This late supply is depicted by this parameter.

β: Coefficient of supply shortage influences deferred supply rate, $0 \le \beta \le 1$.

$S(t)$: Vehicle demand when shortage occurs at time t.

T: The length of the relocation cycle.

Assumptions:

$DS(t)$: Shortages could occur. When the number of vehicles in one station is in short supply, deferred supply rate associated with the actual supply shortage. The larger the actual shortage of vehicles, the lower deferred supply rate, because consumers would not make reservations if they saw a long queue. Hence, suppose that the deferred supply rate associated with the supply shortage, then

$$DS(t) = r - bS(t), \qquad t_s \le t \le T$$

where T is the time of next vehicles redistributed to the station.

$\bar{Q}$: when shortage occurs, the replenishment(Redistribution) policy of every cycle is to replenish to the initial inventory for the station.

Model Establishment

The relationship between company determining replenishment time z and station vehicle inventory depleting time t_s is: When Z is less than t_s, there will be no shortage in the station; when Z is greater than t_s, shortage will occur in the station in some degree of probability.

Based on the notations made in section 3.2.1, the change of vehicle inventory is affected by the demand that is defined in section 3.2.1, that is:

$$DI(t) = \begin{cases} -r - aI(t), & 0 \le t \le t_s \\ -r, & t_s \le t \le T \end{cases}$$

We rewrite the above notation as differential format: that is inventory level $I(t)$ with respect to time t can be described by the following differential equation:

$$\frac{dI(t)}{dt} = \begin{cases} -r - \alpha I(t), & 0 \le t \le t_s \\ -r, & t_s \le t \le T \end{cases} \tag{15}$$

From $I(t_s) = 0$, we have

$$I(t) = \begin{cases} \frac{r}{\alpha}(e^{\alpha(t_s - t)} - 1), & 0 \le t \le t_s \\ r(t_s - t), & t_s \le t \le T \end{cases} \tag{16}$$

$$I(0) = \frac{r}{\alpha}(e^{\alpha t_s} - 1) \tag{17}$$

(i). Expected inventory in per cycle:

$$\begin{aligned} \bar{I} &= \int_{z_1}^{t_s} \int_0^z \frac{r}{\alpha}(e^{\alpha(t_s - t)} - 1) f(z) dt dz + \int_{t_s}^{z_2} \int_0^{t_s} \frac{r}{\alpha}(e^{\alpha(t_s - t)} - 1) f(z) dt dz \\ &= \int_{z_1}^{t_s} [\frac{r(e^{\alpha t_s} - e^{\alpha(t_s - z)})}{\alpha^2} - \frac{rz}{\alpha}] f(z) dz + \int_{t_s}^{z_2} [\frac{r(e^{\alpha t_s} - 1)}{\alpha^2} - \frac{rt_s}{\alpha}] f(z) dz \end{aligned} \tag{18}$$

Eq. (18) represents the expected vehicles' inventory in per cycle, where the first term represents the expected inventory when shortage does not occur; the second term represents the expected inventory when shortage occurs.

(ii). Expected deferred supply and lease loss in per cycle

When shortage occurs, there is a linear relationship between deferred supply rate and shortage, thus, $S(t)$ satisfies the following equation:

$$\begin{cases} \dfrac{dS(t)}{dt} = r - \beta S(t), & t_s \le t \le T \\ S(t_s) = 0. \end{cases} \tag{19}$$

The solution of Eq. (19) is

$$S(t) = \frac{r}{\beta}(1 - e^{\beta(t_s - t)}), \quad t_s \le t \le T \tag{20}$$

Since the total expected shortage in one cycle is the sum of expected deferred supply and expected lease capacity, while the expected deferred supply of each cycle is

$$\bar{B} = \int_{t_s}^{z_2} S(z) f(z) dz = \int_{t_s}^{z_2} \frac{r}{\beta}(1 - e^{\beta(t_s - z)}) f(z) dz \tag{21}$$

Thus, the expected lease loss of each cycle is

$$\bar{L} = \int_{t_s}^{z_2} r(z - t_s) f(z) dz - \int_{t_s}^{z_2} S(z) f(z) dz = \int_{t_s}^{z_2} [r(z - t_s) - \frac{r}{\beta}(1 - e^{\beta(t_s - z)})] f(z) dz \tag{22}$$

In Eq. (22), the first term represents the total expected shortage when vehicles are out of stock; the second term represents the expected deferred supply when vehicles are out of stock.

(iii). Expected replenishment in per cycle

Since the replenishment policy of every cycle is to relocate vehicles to initial numbers of the station, thus, the expected relocation in one cycle is the sum of expected lease capacity and expected deferred supply, that is

$$\begin{aligned} \bar{Q} &= \int_{z_1}^{t_s} [I(0) - I(z)] f(z) dz + \int_{t_s}^{z_2} [I(0) + S(z)] f(z) dz \\ &= \int_{z_1}^{t_s} \frac{r(e^{\alpha t_s} - e^{\alpha(t_s - z)})}{\alpha} f(z) dz + \int_{t_s}^{z_2} [\frac{r(e^{\alpha t_s} - 1)}{\alpha} + \frac{r}{\beta}(1 - e^{\beta(t_s - z)})] f(z) dz \end{aligned} \tag{23}$$

Model Solving

By using above analysis, more specifically, using Eq. (15) to Eq. (23) can answer the questions of station size and policies of vehicles' relocation. We use following statement to show how to address these questions:

Since t_s is the total time from the highest inventory level drop to zero, use our assumptions can lead to the following equation:

$$D(t) = \bar{Q} \tag{24}$$

That is

$$r + \alpha I(t) = \bar{Q} \tag{25}$$

Using the substitution of $I(t)$ and $\bar{Q}$, Eq. (25) becomes

$$re^{\alpha t_s} = \frac{r}{\alpha} \int_{z_1}^{t_s} (e^{\alpha t_s} - e^{\alpha(t_s - z)}) f(z) dz + \frac{r}{\alpha} \int_{t_s}^{z_2} (e^{\alpha t_s} - 1) f(z) dz + \frac{r}{\beta} \int_{t_s}^{z_2} (1 - e^{\beta(t_s - z)}) f(z) dz \tag{26}$$

Then, we have

$$e^{\alpha t_s} = \int_{z_1}^{t_s} \frac{e^{\alpha t_s} - e^{\alpha(t_s - z)}}{\alpha} f(z) dz + \int_{t_s}^{z_2} [\frac{e^{\alpha t_s} - 1}{\alpha} + \frac{1}{\beta}(1 - e^{\beta(t_s - z)})] f(z) dz \tag{27}$$

Let $\Phi = \int_{z_1}^{t_s} \frac{e^{\alpha t_s} - e^{\alpha(t_s - z)}}{\alpha} f(z) dz$, $\Psi = \int_{t_s}^{z_2} [\frac{e^{\alpha t_s} - 1}{\alpha} + \frac{1}{\beta}(1 - e^{\beta(t_s - z)})] f(z) dz$ then, we can obtain

$$t_s = \ln(\Phi + \Psi)^{\alpha} \tag{28}$$

Theorem (Existence and Uniqueness). Suppose $Z = [z_1, z_2]$ is the time break between two continuous replenishments, $\forall t \in [z_1, z_2]$ is a random variable and satisfies independent identically distributed. Then, there must exist a unique time point $t_s \in [z_1, z_2]$ such that $I(t_s) = 0$.

Proof: We first prove the existence of t_s.

If t_s is the total time from the highest inventory level to zero, then $I(t_s) = 0$, $(z_1 \le t_s \le z_2)$, we prove the problem according to the following different circumstance:

(i) When $t_s = z_1$, $I(z_1) = D$, represents the expected inventory in per cycle of a certain business station.

(ii) When $t_s = z_2$, $I(z_2) = \bar{Q}$, represents the upper limit of replenishment in per cycle of a certain business station. From the assumptions, we know the replenishment policy is

$$D(t) = \bar{Q} \tag{29}$$

That is

$$I(z_1) = I(z_2) \tag{30}$$

From Eq. (15) and Eq. (18), we have that the vehicle inventory function $I(t)$, $t \in [z_1, z_2]$ is continuous on interval $[z_1, z_2]$ and differentiable on interval (z_1, z_2), from Eq. (30), we have $I(z_1) = I(z_2)$. According to Rolle's Mean Value Theorem (Stewart, 2009), there is at least one point ξ in (z_1, z_2) where $I'(\xi) = 0$. Let $t_s = \xi$, then, the existence of t_s is proved.

Next, we prove the uniqueness of t_s.

Since the running process of each lease and replenishment cycle almost identical. Thus, only one lease and replenishment cycle were discussed in this paper. From the assumptions, we know that as time point of replenishment, t_s will appear only once in one lease and replenishment cycle, in the rest time of this cycle, the replenishment will be gradually increased to the expected inventory, at this moment, a new lease and replenishment cycle was beginning. The uniqueness of t_s is proved.

This completes the proof.

Substitute t_s into Eq. (17) and Eq. (20), the problem of product deployment and redistribution proposed in section 3.2 can be effectively solved.

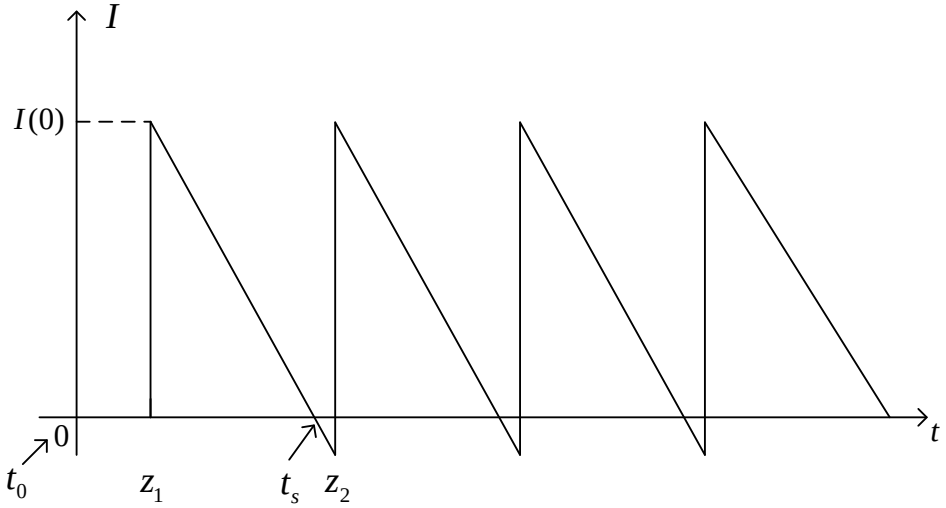

Fig. 2 Variation of inventory over time

APPLICATIONS AND CONCLUSIONS

An application with numerical example:

As we know, a Car-sharing company can only allocate limited number of vehicles to a station; thus, it is impossible to meet all the demands from consumers for every moment. Therefore, it is a challenge for a car-sharing company to face how a station can provide better user experiences with limited vehicle recourses. In this section, we conduct a numerical study to illustrate how to use our previous developed model handle this question.

By following the model, we first need to obtain an estimation of parameter α (Parameter α expresses the continued ramifications of Inventory level/shortage statement on customer car rental behavior). Because customers' car rental

behavior is constantly changing, so to better understand the customers' need, a survey was suggested. We conducted a randomized trial to address this question. Details of randomized trial are as follows:

C1: Survey time. Choose a random 10 days as experiments time window(9:00am-3:00pm); Choosing 10-days is to make sure weekend is covered.

C2: Survey place. Zipcar station in the York College of Pennsylvania(YCP);

C3: Survey environment. After the first occurrence of vehicle shortage in the station;

C4: Survey respondent. The first five customers when the first shortage occurred every survey time;

C5. Survey method. Within vehicle replenishment period or rented vehicle return period, no people leaves the station means the influence ratio of shortage on rental behavior is 0 ($\alpha = 1$); one out of five customer leaves The station means the influence ratio of shortage on rental behavior is 20% ($\alpha = 0.8$); two out of five customer leaves The station means the influence ratio of shortage on rental behavior is 40% ($\alpha = 0.6$); three out of five customer leaves The station means the influence ratio of shortage on rental behavior is 60% ($\alpha = 0.4$); four out of five customer leaves The station means the influence ratio of shortage on rental behavior is 80% ($\alpha = 0.2$); all five customers leave The station means the influence ratio of shortage on rental behavior is 100% ($\alpha = 0$).

C6: Survey conclusion. At the end of ten days survey, we obtained the survey data of vehicle shortage on customer rental behavior. And then we calculate results of influence ratio α, detailed results are shown in following table.

Alpha α	0	.2	.4	.6	.8	1
# of Days	4	4	1	1	0	0

Remark1: We may have observed that Zipcar company does not place more than 5 vehicles in one business station, so, this paper limits the number of survey respondent within 5 people.

Remark2: The average vehicle replenishment period should be less than or equal to the time walk to the nearest Zipcar station.

From above Table, we found that different situation (how many customers leave for how many days within the survey period in YCP college station, in the Table, we have 6 different values of α shown in the last column) leads different result of parameter α, each result represents an attitude of customer in using Zipcar service in the station and could not be ignored. Therefore, we use weighted average value of the 6 different α as the final result. The calculate process is

$$\alpha = \frac{4}{10}\times 0 + \frac{4}{10}\times\frac{1}{5} + \frac{1}{10}\times\frac{2}{5} + \frac{1}{10}\times\frac{3}{5} + 0\times\frac{4}{5} + 0\times\frac{5}{5} = 0.18 .$$

For parameter β and time interval $[z_1, z_2]$, as these two parameters can be controlled and counted by the company itself, so, let's assume we set the parameter: $\beta = 0.65,\ \ Z = [1, 3.5]$.

Plug $\alpha = 0.18, \beta = 0.65$ and time interval $Z = [1, 3.5]$ (hour) into Eq. (27), we have

$$e^{0.18t_s} = \int_1^{t_s} \frac{e^{0.18t_s} - e^{0.18(t_s - z)}}{0.18} f(z)dz + \int_{t_s}^{3.5} [\frac{e^{0.18t_s} - 1}{0.18} + \frac{1}{0.65}(1 - e^{0.65(t_s - z)})] f(z)dz \tag{34}$$

By solving Eq. (34), we can obtain $t_s = 2.39$.

Plug t_s into Eq. (17), we can obtain initial inventory, which is also the expected replenishment inventory in each cycle.

$$I(0) = \frac{1}{0.18}(e^{0.18\times 2.39} - 1) = [2.98] = 3 \tag{35}$$

From Eq. (35), we can address the deployment and redistribution problem for such a station. The final calculate results show the car-sharing company should deploy no less than 3 vehicles in the surveyed station and every 2.39 hours the Company should make a replenishment to make the number of rental vehicles run up to the initial inventory with offering one-way rental business.

CONCLUSION AND FUTURE WORK

Car-Sharing industry grows rapidly in past decades, the popularity of car-sharing programs not only help consumers financially, but also create tremendous social benefits for public and environment. As a fast-growing business, companies constantly seek business expand strategies and react to growing demands from public.

In this paper, we develop a novel model to help car-sharing companies make decisions on station capacity/size and vehicles relocation. We use inventory philosophy to build a model to estimate station's capacity and the number of vehicles that need to relocate if a sudden demand appears.

And our new models can be generalized and easily implemented; our models offer suggestions to managers and while require much less inputs, which could reduce companies' significant costs.

The limitation in our paper, we do not consider availability of parking spots. We assume transferred vehicles would have guaranteed parking spots, which is not a general case in practice.

The future work in car-sharing study could be extended in two directions: study vehicle relocation problems between regions under complete free float scenario, which is more expensive and costly. New strategies may need to be addressed in this situation. In addition, car-sharing industry is very promising, but there are over 90 programs running in US, competition cannot be avoided in some big cities. It would be very interesting to see how decisions would be changed if competitions have been considered.

REFERENCES

Ait-Ouahmed, Amine, Didier Josselin, & Fen Zhou (2018). Relocation optimization of electric cars in one-way car-sharing systems: Modeling, exact solving and heuristics algorithms. *International Journal of Geographical Information Science*, *2*(2).

Barth, M. & Shaheen, S. (2002). Shared-use vehicle systems: Framework for classifying carsharing, station cars, and combined approaches. *Transportation Research Record: Journal of the Transportation Research Board 1791*(1), 105-112.

Barth, M, & Todd, M. (1999). Simulation model performance analysis of a multiple station shared vehicle system. *Transportation Research Part C: Emerging Technologies 7*(4), 237-259.

Barth, M., Todd M., & Xue, L. (2004). User-based vehicle relocation techniques for multiple-station shared-use vehicle systems. *Transportation Research Record 1887*(8).

Cepolina, E. M., & Farina A. (2012). A new shared vehicle system for urban areas. *Transportation Research Part C: Emerging Technologies 21*(1), 230-243.

Cheung, R. K. and W. B. Powell (1996). An algorithm for multistage dynamic networks with random arc capacities, with an application to dynamic fleet management. *Operations Research 44*(6), 951-963.

Navigant Consulting, http://www.navigantresearch.com/research/carsharing-programs.

Correia, G. H. d. A., & A. P. Antunes (2012). Optimization approach to depot location and trip selection in one-way carsharing systems. *Transportation Research Part E: Logistics and Transportation Review 48*(1), 233-247.

Enoch, M. P., & Taylor J. (2006). A worldwide review of support mechanisms for car clubs. *Transport Policy 13*(5): 434-443.

Fan, W., Machemehl R. & Lownes N. (2008). Carsharing: Dynamic decision-making problem for vehicle allocation. *Transportation Research Record: Journal of the Transportation Research Board, 2063*(1), 97-104.

Fan, W. and Xu Y. (2013). Management of dynamic vehicle allocation for carsharing systems. *Transportation Research Record: Journal of the Transportation Research Board, 2359*(1), 51-58.

Horn, R. A., & Johnson, C. R. (2012). *Matrix analysis* (2nd Edition). Cambridge University Press.

Jorge, D., Correia G. H. A., & Barnhart C. (2014). Comparing optimal relocation operations with simulated relocation policies in one-way carsharing systems. *Intelligent Transportation Systems, IEEE Transactions 15*(4), 1667-1675.

Kek, A., Cheu R., & Chor M. (2006). Relocation simulation model for multiple-station shared-use vehicle systems. *Transportation Research Record: Journal of the Transportation Research Board, 1986*(1), 81-88.

Kek, A. G. H., Cheu, R. L., Meng Q., & Fung, C. H. (2009). A decision support system for vehicle relocation operations in carsharing systems. *Transportation Research Part E: Logistics and Transportation Review 45*(1), 149-158.

Nair, R. & Miller-Hooks, E. (2010). Fleet Management for Vehicle Sharing Operations. *Transportation Science 45*(4), 524-540.

Rickenberg, T. A. A., Gebhardt A., & Breitner M. H.. (2013). A decision support system for the optimization of car sharing stations. *ECIS 2013 Completed Research*, Paper 207.

Shaheen, S., & Cohen A.. (2013). Innovative mobility carsharing outlook: Carsharing market overview, analysis, and trends. *Transportation Research Center: eScholarship, UC Berkeley*.

Shaheen, Susan, & Cohen, Adam (2020). Innovative mobility: Carsharing outlook carsharing market overview, analysis, and trends. *UC Berkeley unpublished work.*

Shu, J., Chou, M. C., Liu, Q., Teo, C.-P., & Wang I. L.. (2013). Models for effective deployment and redistribution of bicycles within public bicycle-sharing systems. *Operations Research 61*(6), 1346-1359.

Smith, S., M. Pavone, Schwager, M., Frazzoli E., & Rus, D.. (2013). Rebalancing the rebalancers:Optimally routing vehicles and drivers in mobility-on-demand systems. *American Control Conference, Washington, DC*, *6*.

Strohle, Philipp, Flath Christoph, and Garttner, Johanners.. (2019). Leveraging customer flexibility for car-sharing fleet optimization. *Transportation Science*, *53*(1).

Wagner, S., Brandt, T., & Neumann D.. (2015). Data analytics in free-floating carsharing: Evidence from the city of Berlin. *48th Hawaii International Conference on System Sciences*.

Wang, Ling & Ma Wanjing (2019). Optimization of dynamic relocation operations for one-way electric car-sharing systems. *Transportation Research Part C: Emerging Technologies, 101*, 55-69

Weikl, S., & Bogenberger K.. (2012). Relocation strategies and algorithms for free-floating car sharing systems. *15th Interantional IEEE Conference on: Intelligent Transportation System (ITSC)*

.

Weikl, Simone, & Bogenberger, Klaus. (2015). A practice-ready relocation model for free-floating car-sharing systems with electric vehicles – mesoscopic approach and field trail results,. *Transportation Research Part C: Emerging Technologies*, *57*, 206-233.

Zheng, Z. X. (1994). *Theory of functional differential equations*. Anhui Education Press.

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James M. Emig, Villanova University

ABSTRACT

Based upon our experience teaching at both a large private university with a top ranked accounting program and also at a public university in the Pennsylvania State System of Higher Education, in our view, some students have grown accustomed to memorizing what the textbook and professors say (maybe even with a review session before exams to go over what will be on the exam) and then parroting it back on exam day -- often to get a good grade. The students suffering a "mental enema" after leaving the classroom. In other words, these students are satisfied and often rewarded grade-wise, for becoming "human parrots". In today's world with Google available to "look everything up", we do not see a tremendous future for human parrots. Instead, we are trying to get students to become adaptive problem solvers -- who will be better able to handle future opportunities and problems that do not even exist today.

Specifically, our two main objectives are to first simplify accounting presentations to help students understand – NOT to "dummy down" accounting, and second to prepare our presentations so they are transferable to the distance learning environment.

How do we do it? 1.) We expose our students to some of the controversial items facing the accounting/business world in a rapidly changing environment, 2.) We stress the "Whys" -- not simply the "Hows", and 3.) We state when and why we don't always agree with the textbook.

INTRODUCTION

We do not hesitate to point out current issues confronting the accounting/business world. We share the "Good, Bad, & the Ugly" with our students. Our intent is to get students to realize multiple positions can exist. In our opinion, accounting is still more of an art than a science and is often influenced by "political pressure" from the various views of the stakeholders on what accounting should be. Accounting is a lot more than memorizing debit and credit journal entries, GAAP pronouncements, and fancy terminology.

We prohibit the even mention of "debits and credits" in Chapter One of our introductory accounting classes. Many, or even possibly most, of our introductory accounting students have zero plans to major in accounting and make it a career. We tailor the course to all students, regardless of their current view towards a major and their early thoughts of career choice. Understanding what the numbers mean and what they do not mean -- NOT memorizing -- will be crucial to their future decision-making.

We use a "Plus/Minus transaction worksheet" based on understanding transactions and their impact on the accounting equation as a bridge into debits and credits in Chapter Two. Thus, our introductory accounting course becomes an "Introduction to Business" course – with an emphasis that if you UNDERSTAND the numbers – you have the power.

In both introductory accounting and in intermediate accounting, we replace "fancy terminology" with short concise alternatives that we believe are much more understandable and useful. In both introductory accounting and intermediate accounting, we ban the use of the textbooks' "nominal accounts" and the textbooks' use of the "Income Summary" account. We replace "Nominal accounts" with "Temporary Retained Earnings Accounts" and close the "Temporary Retained Earnings Accounts" directly to Retained Earnings without using the "Income Summary" account. We constantly remind students that we do not do things differently from the textbook just to be different. We give our alternative where it will make things easier (simpler) and thus help understanding. We will "correct" something in the textbook that in our opinion is "wrong" and is hindering the students understanding of the issue at hand.

EXAMPLES/ILLUSTRATIONS

In our on-line version of the paper, we have links to our Embedded Voice-Over PowerPoints and or Videos that we use for our distance learning classes.

For this print version of our paper, we have replaced the actual links with the words "In the on-line version of our paper, this would be a link to Embedded Voice-Over PowerPoints and/or Videos."

Current Issues Facing the Accounting/Business World and Political Pressures of Accounting Rulemaking

In the on-line version of our paper, this would be a link to Embedded Voice-Over PowerPoints and/or Videos.

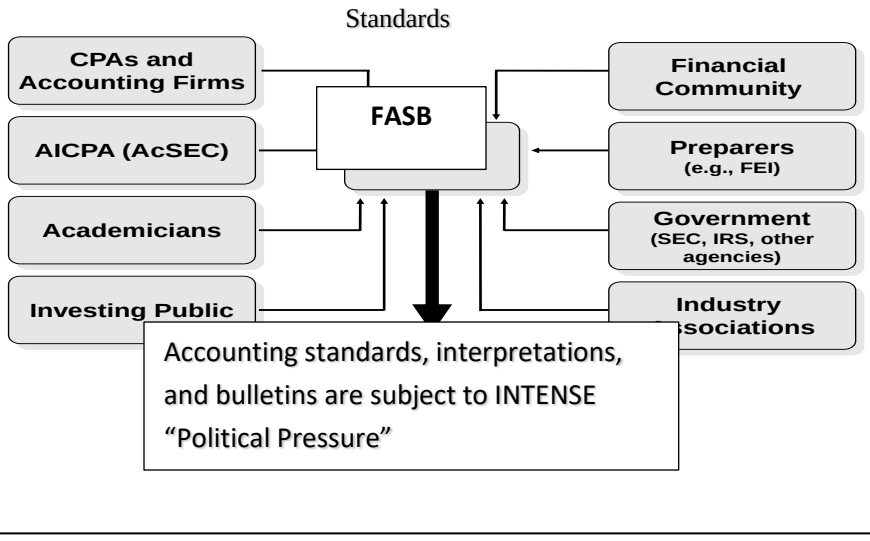
GAAP, FASB, and "Political" Pressure

Good, Bad, & Ugly – Share with Students

Need to Develop Standards

The accounting profession has attempted to develop a set of standards that are generally accepted and "universally" practiced.
"Generally Accepted Accounting Principles"
(GAAP)
AKA "Cleverly Rigged Accounting Ploys"
(CRAP)
AKA "Preposterous Old Obsolete Principles"
(POOP)

Political Pressure Influencing Accounting Rulemaking

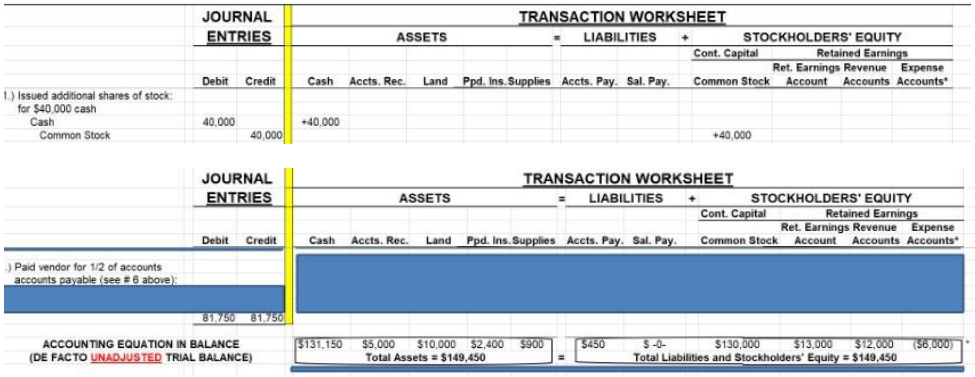


We Stress the "Whys" Not Just the "Hows"

Transition from Plus/Minus
Transaction Worksheet to Debit/Credit Scheme

In the on-line version of our paper, this would be a link to Embedded Voice-Over PowerPoints and/or Videos.

The embedded video shows a step-by-step completion of the Worksheet. First, we require the students to determine the accounts that would be affected by a transaction and "How' -- increase (plus) to that account or a decrease (minus) and "Why". Will the Accounting Equation remain in balance? Below are several views of the worksheet at separate stages of completion: Beginning balances; first transaction completed, totals at end of problem.



JOURNAL ENTRIES		TRANSACTION WORKSHEET											
		ASSETS					= LIABILITIES	+	STOCKHOLDERS' EQUITY				
									Cont. Capital	Retained Earnings			
										Ret. Earnings	Revenue	Expense	
Debit	Credit	Cash	Accts. Rec.	Land	Ppd. Ins.	Supplies	Accts. Pay.	Sal. Pay.	Common Stock	Account	Accounts	Accounts*	
1.) Issued additional shares of stock: for $40,000 cash													
Cash 40,000		+40,000											
Common Stock	40,000								+40,000				

JOURNAL ENTRIES		TRANSACTION WORKSHEET											
		ASSETS					= LIABILITIES	+	STOCKHOLDERS' EQUITY				
									Cont. Capital	Retained Earnings			
										Ret. Earnings	Revenue	Expense	
Debit	Credit	Cash	Accts. Rec.	Land	Ppd. Ins.	Supplies	Accts. Pay.	Sal. Pay.	Common Stock	Account	Accounts	Accounts*	
.) Paid vendor for 1/2 of accounts accounts payable (see # 6 above):													
81,750	81,750												
ACCOUNTING EQUATION IN BALANCE (DE FACTO UNADJUSTED TRIAL BALANCE)		$131,150	$5,000	$10,000	$2,400	$900	$450	$ -0-	$130,000	$13,000	$12,000	($8,000)	
		Total Assets = $149,450					= Total Liabilities and Stockholders' Equity = $149,450						

Alternatives to FASB "Fancy Terminology"

In the on-line version of our paper, this would be a link to Embedded Voice-Over PowerPoints and/or Videos

We will read from the textbook -- (something we rarely do) several technically correct definitions taken from the FASB's Conceptual Framework Statement on 'Elements'.
We state to the class, you already 'know' nine of the ten elements. Then factiously ask class after we have read the FASB's definition of the elements: "You Understand that, right?" After the laughter dies down, we give them our simple (but hopefully more understandable) definitions. All nine elements are covered in the Embedded Voice-Over PowerPoint Slides.

Two examples are given below:

> FASB Definition of Revenues -- Inflows or other enhancements of assets of an entity or settlement of its liabilities (or a combination of both) during period from delivering or producing goods, rendering services, or other activities that constitute the entity's ongoing major or central operations.
> Our Definition of Revenues -- Selling price of goods sold or services rendered. From an early class in Intermediate Accounting I, we also briefly mention the "satisfied our performance obligation under the contract" – with a statement 'we will cover the 5-step approach later'.

FASB Definition of Distributions to Owners -- Decreases in net assets of a particular enterprise resulting from transferring assets, rendering services, or incurring liabilities by the enterprise to owners.
Our Definition of Distributions to Owners – Dividends for a corporation

FASB Qualitative characteristics Making Information Useful. (Relevance vs. Faithful Representation) Investment Manhattan Island.

In the on-line version of our paper, this would be a link to Embedded Voice-Over PowerPoints and/or Videos.

Investment in Manhattan Island Example.

Qualitative Characteristics of Accounting. (FAITHFUL REPRESENTATION) and (RELEVANCE) supposedly make accounting information useful for decision-making. However, Faithful Representation often clashes with Relevance. Our example -- $24 historical cost for Investment in Manhattan Island example vs. $1.7 Trillion current estimated value!

Assuming Peter Minuit Investment Company still owned all of Manhattan Island today and went to the bank to attempt to borrow some money with their only asset -- Investment in Manhattan Island to pledge as collateral. They presented the Company's audited current Balance Sheet and Income Statements from 1626 to the current date. The bank loan officer read the auditor's report stating, "the financial statements are fairly presented in all material respects in accordance with U.S. GAAP."

Will students see the conflict between Relevance and Faithful Representation when the GAAP answer is $24 Asset value on Balance Sheet and cumulative revenue for the last 395 years from the Investment in Manhattan Island is Zero.

We ask the class, what dollar amount would the loan officer at the bank see on the audited Balance Sheet for the Company's sole asset — Investment in Manhattan Island?
From their investment, what would be the Company's profit for the current year and their cumulative total profits for the last 395 years?

It often takes a while, but eventually one brave student will guess $24, the GAAP historical cost valuation. Subsequently, a student will guess zero net income for the audit Income Statement presented in accordance with GAAP. We tentatively agree with both students answers as being 'correct'

We wrap-up our story with the bank loan manager's decision. Since the bank's policy is to loan 80% of 'value', if the Company puts up their Investment in Manhattan Island as collateral, the bank will loan $19.20 -- 80% X $24. GAAP asset valuation. Because of the small risk involved, the bank loan manager agrees to ignore the ZERO total revenues for the last 395 years.

Time to make our Points:

Present the other side of the issue -- why historical cost, what are the significant dangers in presenting Investment in Manhattan Island at estimated fair market value? This is an opportunity to discuss the fair value hierarchy, the International Financial Reporting Standards' position on the extent of using fair value, and the financial statement audit opinion paragraph.

Importance of Understanding what the numbers mean and what they do not mean!

Realizing accounting is an 'art' – not a science and is subject to political pressure and constantly change. Memorizing current GAAP and resultant debit/credit journal entries may help you play the 'human parrot role' on a few quiz shows, but you need more understanding to move up the ladder to becoming an adaptive problem solver!

Who got the better of the deal – Peter or Indians??

When and Why We Disagree with the Textbook

We do some other things differently that most textbooks, NOT just to be different but to promote UNDERSTANDING.

In the on-line version of our paper, this would be a link to Embedded Voice-Over PowerPoints and/or Videos.

Eliminate the use of the "Income Summary" Account from the Closing Journal Entry Process

Most professors use a textbook for financial accounting that uses the term "nominal account" (sometimes being replaced with the term "temporary account") and the textbooks then use an "Income Summary" account in the closing journal entry process. **With the professor using the textbook's approaches, do students really Understand?**

We ask our intermediate accounting students to explain what a nominal account is. A few will correctly describe what nominal accounts are, but virtually no student ever links them to Retained Earnings. We ask our students what type of account is the "Income Summary" account, and which financial statement does it appears on? We have never received a "correct answer" from a student to those two questions. However, we then quickly inform the students that in our over 100+ years of teaching accounting, we haven't figured out answers to our two questions either!

Then, as previously discusses and illustrated in our "Transition from Plus/Minus to the Debit/Credit System" worksheet, we carefully explain and illustrate why we use the term "temporary retained earnings accounts." We do NOT make any journal entries during the accounting period directly into the Retained Earnings account. Instead, we record revenue and expenses, (you could add dividends, gains, losses) in their own "Temporary Retained Earnings Accounts." Our requirement to use "Temporary Retained Earnings Account" (we ban the use of the term "nominal account") is reinforced when we get to the "closing journal entry process" and we close out (i.e., bring back to a zero balance) each temporary retained earnings account by transferring its balance directly into the Retained Earnings account without using the "Income Summary" account – we also ban use of the Income Summary account. At this point, we like to draw the analogy between the temporary retained earnings accounts and a scorecard – every game starts with a 0-0 score and does not carry over from game to game (accounting period to accounting period). This analogy has truly helped students UNDERSTAND the difference in the Balance Sheet account and the Income Statement accounts!

Below is our approach to Closing Journal Entries:

Present a short lecture on the reasons for Closing Journal Entries and the steps they must follow in our courses (i.e. NO Income Summary account).

Closing journal entries – after adjustments and financial statement for the current accounting period have been completed, it is necessary to get the accounting records ready to start the next accounting period by transferring the end-of-period balances in the Revenue, Expenses, and Dividends Declared accounts (i.e., the temporary retained earnings accounts) to the permanent Retained Earnings account. (Do NOT use the "Income Summary" to close). If there is an exam problem on Closing Entries – we will mark the use of the "Income Summary" as WRONG.

We explain the two WHYs:

1.) Revenues, expenses, and dividends declared are "temporary." The dollar amounts are only for the current accounting period's financial statements. They should NOT be the beginning balances in next period's financial statements. Therefore, the first objective is to "close out" (i.e., bring back to zero) the balance in each separa
te temporary retained earnings account.

2.) Update the Retained Earnings account from the beginning of the current period balance to the needed ending balance that is on the Retained Earnings Statement and the Balance Sheet.

We do not do things differently than a textbook just to be different. **We only present our alternatives where in our opinion it will make things significantly easier (simpler) and thus materially help student Understanding.**

Next, we illustrate for our students HOW they are required to do the closing entries:
We do a class problem together with the students.

1.) Present an adjusted trial balance and require students to identify the revenue accounts, accounts, dividends declared account (i.e., the temporary retained earnings accounts) – include "Unearned Revenue", Cost of Goods sold, if those accounts have previously been covered.
2.) Facetiously we ask students how to close out the Cash Account? how to close out the Account Payable account? Make sure the students UNDERSTAND before proceeding!
3.) Steps:
   a.) Close each revenue account (increase in Retained Earnings) directly to Retained Earnings
   b.) Close each expense account (decrease in Retained Earnings) directly to Retained Earnings
   c.) Close Dividends account (decrease in Retained Earnings) directly to Retained Earnings
   d.) Close other temporary retained earnings accounts (e.g., gains and losses)
4.) After each journal entry above, we ask our students if the closing journal entry will accomplish the two Why's of closing journal entries.

Back to the WHY to wrap-up closing journal entries and use of the term "temporary retained earnings accounts" by presenting a Post-Closing Trial Balance and asking the students:

   a.) Which accounts are correctly NOT shown on the Post-Closing Trial Balance?
   b.) Which single account has a different balance of the Post-Closing Trial Balance than it had on the Adjusted Trial Balance?

When and Why We Believe the Textbook is Wrong

Accountant's End of Period Worksheet

In the on-line version of our paper, this would be a link to Embedded Voice-Over PowerPoints and/or Videos.

The Accountant's End of Period Worksheet is another example where **we believe that some textbooks, and thus their instructors, presentation of the Accountants' End of Period Worksheet is very misleading and certainly a detriment to student Understanding.**

In preparing the worksheet --a trial run through the end of the period accounting process including a preliminary look at the financial statements -- key procedures are to take each individual account balance from the adjusted trial balance set of columns and place that amount in the financial statement column in which the account balance should appear. In addition, the bottom of the worksheet shows the calculation of both the Net Income for the period and the ending Retained Earnings balance.

To get our students to recognize the "errors", we present a copy of the textbook's illustration of their completed worksheet, and we ask our students to identify the errors. From previous coverage of topics in our course, students are willing to question some items on the worksheet but are reluctant to outright say they are incorrect. This allows us to start the development of auditor's professional skepticism!

In presenting the correct version of the Accountants' End of the Period Worksheet, we confirm our students' suspicions:

   a.) Beginning Retained Earnings Balance belongs on the Retained Earnings Statement -- NOT in the Balance Sheet set of columns on the worksheet.
   b.) Dividends Declared belongs on the Retained Earnings Statement -- Not in the Balance Sheet set of columns on the worksheet.
   c.) Net Income belongs on the Income Statement and Retained Earnings. The income amount in the Income Statement set of columns of the worksheet is correct, but Net Income should NOT be in the Balance Sheet set of columns on the worksheet.

SUMMARY

In today's and tomorrow's world, many careers, not only in accounting, are undergoing significant change with the technology takeover. The Illinois CPA Society recently remarked on this issue as accountants (and future accountants – i.e., accounting students) need to expand from not only the most trusted adviser but also the most strategic adviser. We need to move toward providing more insight. In the end, it comes down to education and preparation, and putting technical skills into practice.

The reference to education and preparation in the previous statement is where we are trying to make a difference. In summary, we encourage students to "think", adaptive problem solvers – not human parrots.

REFERENCES

Cohn, M. (August, 26, 2020). *Accounting TODAY*.

Flynn, K., Derstine, R., & Emig, J.M. (Winter/Spring 2020). The good, the bad, and the ugly of the accounting profession – Should all aspects be shared with students? *Accounting Instructors' Report*.

Derstine R., Emig, J.M., & Grant, T. (Winter 2012). Simultaneous presentation of debit/credit entries and plus/minus transaction worksheet – an aid to student understanding. *Accounting Instructors' Report*.

Catanach, A., & Ketz, E. *Grumpy Old Accountants* [Blog Post]. Retrieved from **http://blogs.smeal.psu.edu/grumpyoldaccountants/**

McKenna, F. *Re*: *The Auditors* [Blog Post]. Retrieved from http://retheauditors.com/

Miller, P.B.W., & Bahnson, P.R. *The Spirit of Accounting* [Blog Post]. https://www.accountingtoday.com/opinion/the-spirit-of-accounting-403-and-done

Selling, T., *The Accounting Onion* [Blog Post]. https://accountingonion.com/welcome-to-the-accounting-onion

Note: Countless other professors, students, and articles have helped us in our attempt to better educate future adaptive problem solvers.

Dr. Robert P. Derstine is a tenured, full professor of Accounting in the College of Business and Public Management at West Chester University. Professor Derstine previously was a tenured, full professor of Accounting at Villanova University where he was voted the recipient of the University's Lindback Teaching Award and was the Inaugural Recipient of the Gerald A. Dougherty Teaching Excellence Award based on a combined vote of Villanova Business School's Faculty and Students. Professor Derstine's love of teaching is further evidenced by his recent stream of research and his many decades teaching CPA and CFA Exam review courses.

Dr. James M. Emig is a tenured, associate professor of Accountancy in the Villanova School of Business. Professor Emig currently serves as the Associate Chair of Accounting in the Accounting and Information Systems Department. Professor Emig is also a recipient of Villanova University's Lindback Teaching Award and was voted by the Business School's Faculty and Students as a recipient of the Gerald A. Dougherty Teaching Excellence Award. Professor Emig's research interests center on promoting student excellence and preparing them for the proverbial 'real-world'. Professor Emig also has taught review courses for both the CPA and CFA exam. In addition, he served as the administrative director of one of the national CPA Exam review courses in the Philadelphia area for over nine years.

STUDENT REACTIONS TO THE USE OF TECHNOLOGY IN ONLINE EXPERIENTIAL MARKET RESEARCH COURSES

David J. DiRusso, Millersville University of Pennsylvania

ABSTRACT

The purpose of this paper is to offer student reactions to performing personal interviews, focus groups and surveys using technology and non-contact methods in an undergraduate Marketing Research course. Feedback from 8 student groups (40 students) total was solicited in the Fall 2019 and Spring 2020 semesters. Students were offered multiple options to implement these forms of research and commented on the efficacy of each. Implications for general online teaching of marketing research and teaching the course during COVID restrictions are offered.

INTRODUCTION

At Millersville University, the Market Research course has been offered for several decades but was only recently taught online during a full 15-week term as part of growing online business programs. This entailed bringing the traditional marketing research report into an online environment, but one in which physical interaction with respondents was still possible and encouraged. A critical component of this course are personal interviews, focus groups and surveys which are part of a broader market research report project that students would traditionally perform in person. The shift to online instruction brought more challenges but also offered several options in terms of how these various methods of research could be implemented. In the spring semester of 2020, the COVID pandemic has made personal respondent contact impossible, thus the project implementation options had to be altered again in a way that personal contact was no longer allowed. This paper will detail student reactions to shifting the project experience online, and then their continued experience during the pandemic restrictions.

LITERATURE REVIEW

Marketing Research is a required course for undergraduate marketing majors in nearly all business school marketing departments in the United States. It is taught as an applications course (Nonis & Hudson, 1999) which is often experiential in nature. It has also seen much development over the past several decades in terms of new methodologies and the sophistication of software used for data collection, analysis, reporting and presentation (Wilson, Neeley, & Niedzwiecki, 2009). Internet based technology in particular has been adopted in the classroom to help students apply critical forms of research. Specialized survey software can be employed for students to learn and implement questionnaires, and multiple forms of chat technology can be used for exploratory research such as focus groups and personal interviews (Malhotra, Dixit, & Uslay 2002). The use of technology for surveys has become so popular, that some textbooks even come bundled with commercial survey software (Brown, Suter, and Churchill 2018). Many instructors opt to use applied market research projects in their courses that entail these forms of research or more, since marketing research are expected to be comprehensive experiences where students should be exposed to qualitative and quantitative tools for solving problems (Malhotra et al., 2002).

ONLINE MARKETING RESEARCH COURSE PROJECTS

Experiential learning in the form of interactive project work is noted as a best practice to enhance student learning (Dobni & Links, 2008) and there is evidence to support the notion that these experiences are more effective than traditional learning (Thyroff 2018). Experiential market research projects are often employed in Marketing Research courses for students to gain critical experience in the field. The projects can require multiple methods of qualitative or quantitative research including personal interviews, focus groups and surveys, all of which can be challenging in an online environment, especially during the COVID pandemic since direct human contact and interaction is central to traditional market research.

At Millersville University students the Marketing Research course are broken up into groups of 5 and are required to complete three personal interviews, one focus group with at least four participants and a survey with at least 80 responses. They are then required to analyze the results with SPSS, which is accessible through the university, and detail their findings in a comprehensive research report. Given the fact that multiple methods of research need to be employed, the projects are performed over an entire semester. The personal interviews and focus groups are completed by week 7 of the semester and the surveys are collected and analyzed by week 13 of the traditional 15-week semester.

With the emergence of online programs, teaching the course in an online format became necessary. Additionally, complications from COVID have arisen to force reliance on technology to teach the course. An overview of managing the project in class verses online is offered below.

Marketing Research Projects In-Class

An instructor managing marketing research projects for students taking an in class version of the course has a number of advantages. Student groups could be formed and observed in person. Attendance, participation and engagement can be observed. Aside from these critical instructor advantages, students are given the most flexibility. Given that students are on or near campus, they can quickly and easily interact with each other and on campus respondents, making in person contact strongly preferable. Surveys could be printed out on paper and hand administered to students on campus or wherever potential respondents congregated. Focus groups and interviews with respondents can be done in person in on or off campus locations. This allows students to have control over the environment for the experience. The location is chosen by them, devices can be silenced and put away and the focus group can be implemented in a distraction free environment. Technology options were discussed in several in person marketing research courses over the past five years, but given the convenience and control offered by in person methods, no group was interested in seriously pursuing these options.

Managing Projects in Online Versions of Course

Students taking the online version of a market research class are faced with greater complications. Some group members may be on or close to campus, others could be anywhere else in the country or the world, which potentially makes meeting as a team impossible. Given whether the course is offered in asynchronous or synchronous formats, instructors may or may not have the ability to monitor group interactions directly. It is still possible for teams to implement focus groups, personal interviews, and surveys in person and work together virtually to compile the research, however in an online environment, students may prefer using technology for a number of reasons. First, they are used to interacting with each other virtually, making them more comfortable doing so with respondents. Given the hardware requirements of taking an online course, each student is much more likely to have a device that would enable them to effectively use a technology based option such as video chat, and may have more experience doing so as an online student. Finally, they may find it much more convenient to use technology to reach respondents as campus is no longer a central location where teams can conveniently find respondents they needed for each form of research. Thus, when the online course was offered, students were given technology options to determine how interested they would be in employing them for each form of research and their reaction after use.

STUDENT REACTIONS TO TECHNOLOGY OPTIONS

The marketing research class was first offered online in a full 15-week term in Fall 2019. Given that students in online marketing research courses could still implement their research through direct interaction with respondents, and many students were on campus students taking the online course, in-person respondent contact was still recommended by the instructor for all personal interviews, focus groups and surveys. However, students were offered several technology-based options as well:

Table 1
Research Implementation Options Available to Students

Form of Research	Options Allowed
Personal interviews	In person, Phone, Video-chat or Text Chat
Focus Group	In person, Video-chat or Text Chat
Survey	In person (Fall 2019 semester only), Google Forms, Email

Individual teams were allowed to choose whichever option they were comfortable with implementing and were then asked to detail their feedback concerning their chosen option. Two asynchronous sections of the market research course were analyzed, each with four teams of 5 students. The first course was in the Fall 2019 semester, and the next in the Spring 2020 semester, which was affected by COVID restrictions which banned the use of in-person survey implementation. The options presented to each student team, their choices, and their feedback are offered below.

Fall 2019 Semester Groups

The fall 2019 semester was unaffected by COVID. Students chose the following implementation methods for their research as described below in Table 2.

Table 2
Fall 2019 Implementation Choices

Team	Personal Interview Method	Focus Group Method	Survey Method
1	In person	Text Chat	Google Forms
2	In person	Facetime	Google Forms
3	In person	In person	Google Forms
4	Facetime (1) and In person (2)	In person	Google Forms

Every team decided to perform at least one personal interview in-person and three of the four teams implemented all interviews in this fashion. A single group interviewed a single person as that respondent could not meet physically. Aside from this single case, students said that it wouldn't be more convenient to do a virtual method because they knew and had regular contact with interviewees, thus organizing a phone, video or text chat was not worthwhile. Some groups also noted that they believed it was easier to establish a rapport with the interviewee in person than it would be using technology.

For the focus group, half of the groups chose to do in person. Similar to personal interviews, they did have close contact with respondents, so it was not easier or more convenient for them to use technology. One group used Facetime to video chat and did not report any major issues. A single group used text chat and did note that they received some high-quality answers, but due to the limitations of texting, they ran into some issues. The student moderator and all participants were texting on a phone so the process was described as "drawn out" as everyone had to take much more time typing out their answers on their phone, which led to a number of awkward pauses. Still they did receive thorough answers to questions.

Google forms was entirely chosen as the method for administering surveys. Students noted that Google Forms was exceptionally easy to learn, easy to create their questions in, and easy to obtain responses, and easy to bring the data into an SPSS file for analysis. Each group self-taught themselves the software through the tutorial found on Google Workspace Learning Center. The instructor did not offer any assistance in learning or using Google Form software and no questions were asked by students about the software.

Spring 2020 Semester Groups

The Spring 2020 semester was affected by COVID. Students already completed their interviews and focus groups before pandemic restrictions were implemented in PA. However, the survey was forced to be administrated virtually as students were no longer permitted to have contact with respondents.

Table 2
Spring 2020 Implementation Choices

Team	Personal Interview Method	Focus Group Method	Survey Method
1	In person	Text Chat	Email
2	Facetime (1) and In-person (2)	Facetime	Google Forms
3	In person	In person	Email and Social Media
4	Phone (1) and In-person (2)	In person	Google Forms

Similar to the Fall 2019 set of students, every group in Spring 2020 at least partially implemented an in-person technique for their personal interviews and brought up the same reasons of convenience for doing so. The interview performed by Facetime was noted to have gone smoothly as was the interview administered by phone. The group noted the lack of ability to see how people would physically respond to each question via phone, but still could measure response latency.

The results of the focus groups were the same as with Fall 2019. Half of the teams chose in person and also noted the same reason of convenience. Another group did Facetime and did note some mild connection issues which forced them to ask respondents to repeat themselves, but no other issues. Another group employed texting and noted the same issues as the fall 2019 team who utilized the same method. For this team, they noted that they wanted to do a video chat, but not all of their chosen respondents had an iPhone and the team was not comfortable enough using video chat that wasn't Facetime despite their access to Zoom through the university. The group noted the same issues as in the previous semester, but also noted that the lag hurt because some respondents wanted to type long answers to questions, and submitted them to the group chat after the moderator moved on to the next subject. This created some confusion and made it hard to manage.

For the survey, half of the groups used Google forms and the other half used email in some way. The groups that used Google Forms again noted that they were able to easily learn the software and implement the survey through the tutorial offered by Google. The groups who did not, preferred to send the word document survey via email directly in which respondents then filled out then sent back. They noted that this was time consuming but otherwise effective. One group also actively solicited respondents from their social media accounts and that was effective as well. The groups who used email also noted that they would have preferred to hand out paper copies of the survey.

Implications for Current and Future Instruction

In an online version of the class not affected by COVID restrictions, students appreciated the flexibility to implement their research in either traditional or technology-based formats regardless of what they chose. For personal interviews, groups heavily preferred personal interaction, with every single group employing this for at least some interviews. This shows that even in an online environment with several technology-based alternatives, students still appear to want to implement interviews in-person. This highlights the importance of offering students the ability to personally interact with respondents when possible for the online marketing research project. Still, technology was chosen by several groups and necessary for others. Additionally, COVID restrictions force the need for technological interaction, thus the recommended options to be used for the instructor for each major type of research is offered below.

Table 3
Recommended Technology for Online Market Research Projects

Interviews	Focus Group	Survey
Phone or Video Chat	Video Chat	Google Forms

Positive results were achieved with both phone and video chat for Interviews, thus either could be used effectively unless the instructor wishes the student to view respondents' body language during the interview. It should be noted that Facetime is not explicitly recommended due to the requirement of an Apple Device, which was noted as an issue by a group. Zoom or any similar software that is made available to the students that would allow respondents the

flexibility to utilize any device to participate would make the process easier. However, students may be more comfortable with university supplied video chat software such as Zoom now that they have likely been forced to use it in other classes during COVID affected terms. The author is monitoring the course this Fall 2020 semester to see if that is the case.

Additionally, it should be noted that students are most likely to be disappointed about not being able to implement in-person interviews, as this was the clear preference amongst them. However, this restriction is necessary for most instructors during COVID.

Focus groups were split evenly with half of the groups choosing in person and the other half choosing technology. Video chat is again recommended for focus groups as they allow immediate respondent feedback and good moderator control. Texting has major flaws when used as a focus group method due to the very slow typing speed of respondents and should only be considered if absolutely necessary. Like personal interviews, video chats should be encouraged through the format offered by the university instead of Facetime so respondents without an Apple Device can participate.

Technology was chosen to implement surveys for all groups, but it should be noted that 2 out of the 4 groups in the Spring 2020 semester would have preferred to personally administer their surveys. Google Forms was widely touted by the groups who chose to use it. It received incredibly positive feedback amongst students and the instructor will likely not have to assist students in learning or implementing surveys through this method as the tutorial offered by Google (*Google Workspace Learning Center*, n.d.) has shown to be more than sufficient for students to learn the software on their own, removing the need to dedicate class time to instructing them on how to use it. This makes it an excellent option for students to employ and can be time saving compared to traditional surveys.

The pandemic has forced instructors teaching marketing research to implement a variety of technologies in order to facilitate student experiences with major forms of marketing research. Multiple student teams have reacted positively to the recommended methods, so there is evidence to support that they could be used effectively during the pandemic and beyond.

REFERENCES

Brown, T. J., Suter, T. A., & Churchill, G. A. (2018). *Basic marketing research: Customer insights and managerial action*. Australia: Cengage.

Dobni, D., & Links, G. (2008). Promoting Statistical Intelligence in Marketing Research Students: Best Practice Ideas. *Marketing Education Review, 18*(1), 61-64. doi:10.1080/10528008.2008.11489026

Google Workspace Learning Center. (n.d.). Google. Retrieved September 1, 2020, from https://support.google.com/a/users/answer/9991170?hl=en

Malhotra, N. K., Dixit, A., & Uslay, C. (2002). Integrating Internet Technology in Marketing Research Education. *Marketing Education Review, 12*(3), 25-34. doi:10.1080/10528008.2002.11488797

Nonis, S. A., & Hudson, G. I. (1999). The Second Course in Business Statistics and Its Role in Undergraduate Marketing Education. *Journal of Marketing Education, 21*(3), 232-241. doi:10.1177/0273475399213008

Thyroff, A. (2018). Teaching Qualitative Marketing Research: An Experiential Approach. *Marketing Education Review, 29*(1), 75-87. doi:10.1080/10528008.2018.1514979

Wilson, H., Neeley, C., & Niedzwiecki, K. (2009). Content and Method in the Teaching of Marketing Research Revisited. *Journal of Instructional Pedagogies*, *1*, 1-15

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INFORMATION DIAGNOSTICITY INFLUENCES ON ONLINE CONSUMER PURCHASE INTENTIONS

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ABSTRACT

Utilization of online sales is increasingly prevalent, creating a direct interest in understanding online purchase intention formation. Understanding the diagnostic aspects impacting consumer behavior allows for more accurate prediction of customer purchases. In this study, we look at Information Diagnosticity and its role in explaining criterion differentiation during the purchase intention formation process. Self-reported consumer purchase intentions were solicited in a cross-sectional study of English-speaking Amazon.com customers presented with five survey stimuli. The 218 participants were recruited using Amazon's MTurk platform. This research focused on the impact of information diagnosticity on purchase intentions. Study findings indicate trust and valence-based constructs offer increased insights into purchase intention behavior formation within ecommerce.

INTRODUCTION

Online sales are growing with an estimated e-commerce sales of $599 million by 2024 (Statista, 2020). Ease of online shopping from home at e-retailers like Amazon.com allows for direct home delivery. While the online buyer is unable to assess the physical product while selecting items for purchase, the selection of items maybe greater than those of local brick and mortar stores, as with Amazon.com, including Amazon Marketplace, offers over an estimated 350 million items (Dayton, 2020). While the attraction of online hours of operation (24/7), delivery directly to customers, and selection are all aspects of online shopping, the plethora of items can be overwhelming.

How can a customer determine items to purchase without physically evaluating them? Many consumers substitute traditional word-of-mouth between friends with electronic word-of-mouth (eWOM) from online customer reviews to base selection criteria for purchase (Kim & Park, 2013; Wu, 2013; Guo, Wang, & Wu, 2020). The one-to-many communication reach of eWOM, specifically consumer-generated, consumption-related communications, increases the influential power of a single consumer's review from the traditional face-to-face word-of-mouth sharing to a wider, internet based audience.

Selecting an online retailer is similar to adopting new technology. Prior research into online commerce evaluated customer acceptance of retailers using ecommerce technology acceptance model (eTAM) (Klopping & McKinney, 2004), this parsimonious model focuses on three constructs of online retail purchase intention predictors. Constructs representing behavioral intentions, which equate with purchase intentions (PI), perceived ease-of-use (PEOU), and perceived usefulness (PU) were determined to be predictive of e-commerce adoptions (Klopping & McKinney, 2004).

eTAM was found to be useful in predicting e-commerce platform selection, but does not account for diagnostic criterion consumers utilize in determining purchase intentions. Once a platform is selected, the influence of eWOM and additional factors influencing purchase intentions are not represented in eTAM, leaving room for an improvement on the model. This study builds on research by Gurney, Eveland, and Guzman (2019) to assess additional aspects influencing consumer purchase intention formation in online sales.

Social media style communication is significant in determining opinions and gaining insight into online elements. Ecommerce sites facilitating electronic sharing of opinions allow customers to substitute face-to-face evaluations and recommendations of products with social media posting style opinions. eTAM lacks assessing criteria for the influences of socially shared electronic opinions prevalent on product pages online. Contributing factors from eWOM customer reviews include written sentiment (tone) regarding the item, opinions, and experiences expressed (Filieri, 2015). Additionally, valence, representing the positive and negative opinions within written reviews, conveys emotion, impacting reader trust in the review and it's diagnostic content (Guo, Wang, & Wu, 2020). Previous research has shown support for emotional diagnosticity influences, positive and negative valence of content, within eWOM reviews sway purchase intentions (Ghasemaghaei, 2020; Guo, Wang, & Wu, 2020; Gurney, 2018; Gurney, Eveland, & Guzman, 2019).

Decision criteria gleaned from online reviews directly impacts diagnostic aspects of consumer's decision processes. Determining if a product demonstrated positive characteristic that fit the potential buyer's need criteria can be gained from a diagnostic reading of online reviews from previous customer experiences. These experiences, opinions, and expressed written tone (valence) all form part of the purchase intention formation diagnostic criteria and were found to have influences on the categorization of trust within eWOM reviews (Ghasemaghaei, 2020; Filieri, 2015; Mortazavi, Esfidani, & Barzoki, 2014;).

Additionally, trust in the eWOM customer review is impacted by overall trusting tendencies. According to Lee and Hong (2019), consumer trust in the review host site is transferred indirectly to the eWOM review. Increased trust levels a customer has in the vendor indirectly impact trust in the content. Thus, trust in the e-vendor's site allows consumers to determine purchase intentions based on the eWOM feedback.

This research focuses on extending the eTAM through the applications of Information Diagnosticity to account for additional influences impacting purchase intention formation within ecommerce at Amazon.com. Utilizing different valence conditions, the model presented to Amazon customers via an online survey with 218 online participants.

To further provide theoretical foundational information literature on information diagnosticity and purchase intentions is discussed. Furthermore, we present the research model and study description and results, followed by a discussion and conclusion.

THEORETICAL BACKGROUND

Tversky's seminal study (1977) on diagnostic effect, analyzed how diagnosticity was utilized to assess criteria into classification of subgroup clustered items (Evers & Lakens, 2014; Pothos, Barque-Duran, Yearsley, Trueblood, Busemeyer, Hampton, 2015; Menon,1995). This clustered criterion comparison are used to demine differentiation of dissimilar concepts, creating information criteria groups for preference judgements (Andrews & Allen, 2016; Pothos, et al., 2015) as denoted in Information Diagnosticity (ID).

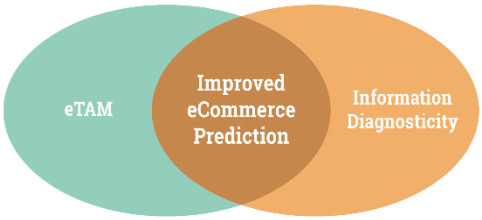
Using the grouping criteria found in eWOM customer product reviews, published on electronic vendor product pages, buyers are able to form differentiating categorization regarding products based on the shared experiences of prior purchasers and create a purchase intention grouping categorizations (Andrews & Allen, 2016; Chau & Banerjee, 2014; Menon, 1995). The diagnostic elements derived from the valence, ratings, documented customer experiences, and engendered trust form informational influences on purchase intention formation, thus the basis for informational differentiation regarding purchase consideration (Andrews & Allen, 2016; Chau & Banerjee, 2014; Evers & Lakens, 2014; Filieri, 2015; Mortazavi, Esfidani, & Barzoki, 2014; Wen, 2020). These categorizations can be thought of as 'low, neutral, or high' potential purchase candidates (Filieri, 2015; Mortazavi, Esfidani, & Barzoki, 2014).

While the trust engendered and experiences evaluated from customer reviews assist in assessing purchase potential, those are not the only information diagnostic elements influencing purchase decision formation; trust in the electronic vendor and in online sales ecommerce platforms (Klopping & McKinney, 2004; Wen, 2020). Attitudes concerning perceive ease-of-use (PEU) and perceived usefulness (PU) have been determined assessable via application of TAM (Beldad & Hegner, 2017; Gefen, Karahanna, & Straub, 2003; Phuong & Vinh, 2017; Yang, Sarathy, & Walsh, 2016). The affective impact of PEU and PU on purchase (behavioral) intentions is illustrated in electronic commerce TAM (eTAM) (Klopping & McKinney, 2004).

Extending eTAM via Information Diagnosticity theory to include the constructs of trust and valence strengthens the predictive aspects of the model and assist in ecommerce purchase intention influence assessment. The perception of positive valence and credibility within eWOM customer reviews impacts purchase decisions (Andrews & Allen, 2016; Filieri, 2015; Chau & Banerjee, 2014; Ghasemaghaei, 2020; Guo, Wang, & Wu, 2020). The influence of diagnosticity on purchase decisions is moderated by the emotional content, valence, of positive or negative reviews. The perception of relevant product information, diagnostic criterion, impacts consumer decision formation, based on the content of eWOM reviews. Recent studies conducted into the impact of positive and negative valenced information and information diagnosticity's supported an effect on decision formation (Dessel, Cone, Gast, & De Houwer, 2020; Guo, Wang, & Wu, 2020).

Trust aspects directly impact the behavioral aspects of purchase intentions (TAM's behavioral construct): without trust in the vendor, the item would not be assessed for purchase. Trust in the customer review is based in the theory of reasoned action (TRA), the antecedent or TAM) and assesses the subjective norms as measured by valence (written tone) within eWOM customer reviews (Gefen, Karahanna, & Straub, 2003; Phuong & Vinh, 2017; Guo, Wang, & Wu, 2020). The proposed model combines elements of the technology acceptance model, theory of reasoned action, and information diagnosticity to enhance the predictive strength of assessing customer purchase intentioned, as based on customer reviews, in ecommerce. Increase the Explanatory Power of TAM through ID extension for e-commerce with eWOM customer reviews on Amazon.com, see Figure 1.

FIGURE 1: *INTERSECTION OF ETAM AND INFORMATION DIAGNOSTICITY*



The inherent trust trait within a person is a contributing factor to online purchasing. Without an inclination to trust online vendors, customers will not seek online purchase options nor trust unfamiliar vending platforms. Commitment to online purchasing is proposed to be higher in those who have greater inclinations to trust (IT) (Chang & Chen, 2008; Gefen, Karahanna, & Straub, 2003; Lee & Hong, 2019).

H1: Greater inclination to trust increases purchase intentions.

Belief that an online transaction will be honored, the financial obligations met, and elements of the transaction will proceed as expected are all part of the buyer's evaluation of trust in an electronic vendor (Chang & Chen, 2008; Hassanein & Head, 2007; Lee & Hong, 2019). Purchase intentions, even item selection, is lowered when a lack of trust is present with regards to an online sales site. Reduction of perceived risk and increase in trust in the vendor (TV) represents a diagnostic aspect that contributes to purchase intention criteria. Increased TV contributes to greater purchase intentions.

H2: Greater trust in the vendor increases purchase intentions.

Trust is an influencing factor in the perception of security in online transaction and interactions. Perceived trust within customer reviews, as assessed from the writing style and content, impacts the diagnostic value of the review in categorization of items for purchase. Potential customer review another's written post about experiences, opinions, and ratings given for a particular product and determine the reliability based on an emotional connection formed by the writing, representing the emotional trust in the review (Lee, Sun, Chen, & Jhu, 2015).

Within the tone, or valence, and verbiage used, a reader is able to evaluate the perceived trustworthiness and honesty of the review in regards to the product. This allows for an assessment of the weight a potential buyer will place in the diagnostic clues identified from the written review forming the emotional trust in eWOM available.

Additional trust aspects influencing buyer consumption of written review cues is cognitive trust. A logical assessment of the written review based on information presented and the manner presented. The cognitive aspects of trust formation in relation to the customer written review are based on the presumed reviewer's motivation as assessed from the valence and wording (Lee, Sun, Chen, & Jhu, 2015; Guo, Wang, & Wu, 2020). The combined trust, cognitive and emotional, are close in nature and allow users to form a mental credibility ranking of reviews read. Trust in the review, based on the content and valence impacts the value placed on decision criteria gleaned from eWOM reviews (Mortazavi, Esfidani, & Barzoki, 2014; Yang, Sarathy, & Walsh, 2016). Lee, Sun, Chen, and Jhu (2015) found that cognitive and emotional trust directly impact purchase intentions as a result of a decision making process.

H3: Greater emotional-cognitive trust in the customer review increases purchase intentions.

Written tone cues (positive, neutral, or negative) represented perceived valence within a customer review impact emotional trust connections formed. The trust in the review is impacted by the 'tone of voice' presented, influencing the level of trust in the diagnostic aspects available within the written review. The emotional trust connections derived from the tone present in the eWOM will have an impact on the reader's purchase intentions (Fogel & Zachariah, 2017; Kim & Park, 2013; Guo, Wang, & Wu, 2020; Lee & Hong, 2019). Stronger valence influenced trust are expected to increase purchase intentions.

Additionally, the cognitive trust inspired by the assessment of the language and intents presented by the written aspects of the customer review impact belief in the statements made. Cognitive trust is partially based on the perceived valence of the written review. The greater the trust in the reviewer's message, the greater the impact on purchase intentions (Filieri, 2015; Fogel & Zachariah, 2017;).

H4: Greater emotional-cognitive trust mediates the relationship between perceived valence and purchase intentions.

Pulling from the ecommerce technology acceptance model (eTAM) (Klopping & McKinney, 2004), online platform adoption is related to user's perceptions of ease-of-use and perceived usefulness (Lim, Osman, Salahuddin, Romle, & Abdullah, 2016). Specifically, the ease in which a consumer can access and complete transactions attracts customers to a specific platform. The ease of using online shopping sites allows for greater acceptance rates of sites with easy to use interfaces.

H5: Greater perceived ease-of-use increases purchases intentions.

Positive shopping experiences, based on usefulness, increase user adoption of online sales sites, according to eTAM. Reducing travel time, the ability to compare multiple items with the click of a mouse button, increased select as with Amazon.com, all contribute to perceived usefulness. Increased adoption rates of online vendors is increased with greater perceived usefulness (PU) (Cho & Sagynov, 2015; Lim, Osman, Salahuddin, Romle, & Abdullah, 2016). Greater PU is expected to increase consumer purchase intentions.

These two constructs are interdepended, perceived usefulness and perceived ease-of-use (PEU), as Klopping and McKinney (2004) demonstrated with their eTAM model. The greater the ease-of-use and usefulness the more likely customers will be to utilize the site and report higher purchase intentions.

H6: Greater perceived usefulness increases purchase intentions.

H7: Greater perceived ease-of-use increases perceived usefulness.

The agreement within a written customer review online is not always consistent. The perceived valence (PV) within the written review may differ from the valence condition presented, normally represented by star ratings. Emotional tone and auditory cues presenting emotional nuances are lacking in the written post of a person's eWOM review. A conflict between a low star rating (1 star being negative) and a high star rating (5 stars being positive) as indicated on Amazon.com, may not relate directly with the perceived valence (Filieri, 2015; Liang, Li, Yang, & Wang, 2016). Positive, neutral, or negative tone, valence, may not match with the star rating listed, causing a dissonance in affective information perceived in the diagnostic process for purchase decision making (Ghasemaghaei, 2020; Koo, 2015; Lee, Kim, & Peng, 2013).

H8: Valence condition moderates the relationship between inclination to trust and purchase intentions.

RESEARCH METHODOLOGY

Utilizing a one-time cross-sectional survey exposing participants to multiple emulated online product conditions similar to Amazon.com product pages, five surveys were administered to randomly selected participants, Figure 2. Employing Amazon's MTurk survey service, 218 English-speaking, U.S. Amazon customers self-selected to partake

in the study. Previous research indicated the participants on MTurk more accurately represent the U.S. population than university students (Wu, 2013).

As per standard operating procedure on MTurk, each participant was compensated with a small monetary payment. Demographics indicate the participants were 'not listed' (N=1, .4%), female (N=122, 46.9%), and male (N=137, 52.7%), a predominately equal distribution between male and female – note that other gender options were available for indication, but not selected.

Administration of surveys on Amazon's MTurk service automatically randomizes and obscures participant ids. Responses were therefore anonymous. Repeat MTurk ids were not identified in the data review between surveys. Five separate valence-based surveys were administered to random participants, to limit expected participant fatigue if all five stimuli were presented in one survey.

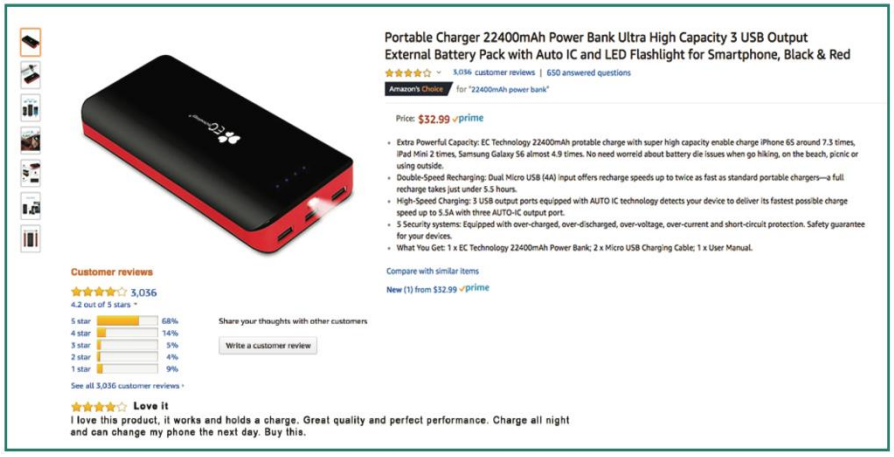
FIGURE 1: *RESEARCH FLOW*

Price point was a consideration in example product selection, choosing to keep the price point low to reduce 'sticker shock' purchase intention influencers. An image of the product, product description, valence conditions, and eWOM customer reviews were mocked up to resemble as closely as possible an Amazon product page, see Figure 3.

To accommodate the different valence combinations, five separate but similar surveys were created. The surveys were identical in all aspects except the adjustment of valence conditions and written review. Customer reviews and the connected star ratings represented the sentiment score (SC) conditions (valence) and the aggregate star ratings (AR) changed per stimuli to create five different valence conditions. Aggregate star ratings specifically represent the overall average of rankings all customers have given a product based on stars. Valence conditions were created using combinations of star ratings, aggregate star ratings (Fagerstrom, Pawar, Sigursson, & Foxall, 2017), and sentiment score valence benchmarked written reviews (Mauri & Minazzi, 2011; Guo, Wang, & Wu, 2020).

Using the IBM Watson Developer Cloud Tone Analyzer tool (Watson: Tone Analyzer, 2017), each written customer review was quantified as 'positive, negative, or neutral' (Liang, Li, Yang, & Wang, 2016; Wu, 2013). IBM Watson generated a numeric score representing strength of valence, or sentiment score.

Figure 3: *Valence Condition Example Stimuli*



Implementing a natural language lexicon analysis for assessment of sentiment score, IBM Watson determine numeric levels of written emotions from 'join, anger, fear, disgust, sadness, and others verbal tendencies. The score is based on combinations of words, structure of the sentences, and the algorithm implemented in the Watson engine (Watson: Tone Analyzer, 2017; IBM, 2018). Written tone, valence, received quantified scores ranging from -1.00 (negative emotions) to +1.00 (positive emotions). Stimulus examples presented to participants were a combination of sentiment score benchmarked written customer review samples, star ratings, and aggregate star ratings, see Table 1.

Table 1: *Sentiment Score Comparisons*

	Sentiment Score Analyzer and Scores		
Verbal Stimuli	**IBM's Watson Tone Analyzer**	**TwinWord Ratio/Score**	**Text2Data**
I hate this product, it doesn't work and won't hold a charge. Poor quality and bad performance. Charged all night and can't charge my phone the next day. Don't buy this.	-0.84 Joy 0.0, Anger 0.22, Disgust 0.12, Sadness 0.73, Fear 0.07	-0.809/-0.414	-0.674
I love this product, it works and holds a charge. Great quality and perfect performance. Charge all night and can charge my phone the next day. I recommend this.	0.90 Joy 0.86, Anger 0.01 Disgust 0.00 Sadness 0.73 Fear 0.07	0.993/0.439	0.889
Standard product, it works and holds a charge. Average quality and performance. Charge all night and can charge my phone the next day. I'd buy again.	-0.03 Joy 0.13, Anger 0.09, Disgust 0.05, Sadness 0.21, Fear 0.02	0.605/0.116	0.193
Sentiment scores +1.00 positive, -1.00 negative, 0.00 neutral.			

Using a Likert scale, participants selected their response ratings from strongly disagree (1) to strongly agree (5). Each of the five stimuli based surveys were administered to randomly selected groups of participants. Each survey asked participants to review the product page presented, valence based stimuli being the only difference between surveys. All questions presented were the same between surveys, see Figure 3 (Gurney, 2018; Gurney, Eveland, & Guzman, 2019). Additional questions assessing length of online shopping and frequency of shopping were included.

Table 2: *Constructs and Reliability*

Construct	Cronbach's Alpha	CR	AVE
Inclination to Trust (IT) Adapted from (Chang & Chen, 2008) IT1: It is easy for me to trust a person/thing. IT2: I tend to trust a person/thing, even though I have little knowledge of them/it. IT3: Trusting someone or something is not difficult. IT4: I feel uncomfortable putting my trust in another person/thing.	.90	.93	.76
Trust in Vendor (TV)	.76	.77	.46
Adapted from (Chang & Chen, 2008; Kim & Park, 2013; Park & Kim, 2008) TV1: Promises made by Amazon's web site are likely to be reliable. TV2: I expect that Amazon's web site's intentions are honest. TV3: I feel comfortable using Amazon's interface to purchase items. TV4: I am likely to purchase products on Amazon. TV5: I find reviews presented on the Amazon's website helpful to my purchase decision making.			
Emotional and Cognitive Trust (ECT)	.93	.94	.67
Adapted from (Lee, Sun, Chen, & Jhu, 2015; Hassanein & Head, 2007) ET1: I feel secure about relying on this customer review for my purchase decision. ET2: I feel comfortable relying on this customer review for my purchase decision. CT1: I trust this customer reviewer had good knowledge about this product. CT2: I feel this product review is honest. CT3: I feel this product review is trustworthy. CT4: I feel that this product reviewer cares about other customers. CT5: I feel that this product review provides relevant information for purchase decision making. CT6: I have reservations about relying on this customer review for my purchase decision.			
Perceived Ease-of-Use (PEU)	.88	.92	.73
Adapted from (Hassanein & Head, 2007) PEU1: Amazon is easy to use to purchase an item. PEU2: Amazon is a user-friendly website. PEU3: Interaction with Amazon's website is clear and understandable. PEU4: I can quickly find the information I need on Amazon's website.			
Perceived Usefulness (PU)	.78	.85	.54
Adapted from (Kucukusta, Law, Besbes, & Legoherel, 2015) PU1: I can complete online purchasing quickly at Amazon. PU2: Purchasing online allows me to use my time efficiently. PU3: Using Amazon to purchase items is easier than traveling to a store. PU4: Using Amazon gives me a larger selection to choose from. PU5: I find it difficult to purchase items on Amazon's website.			
Purchase Intention (PI)	.84	.92	.86
Adapted from (Yang, Sarathy, & Walsh, 2016; Animesh, Pinsonneault, Yang, & Oh, 2011) PI2: Based on the image above, my willingness to purchase this product is high. PI3: Based on the customer review, I would consider purchasing this item.			

MEASUREMENT MODEL ASSESSEMENT

Evaluation of relationships between latent constructs in the model were assessed using SmartPLS 3.0, see Figure 4. A dummy reference variable, for the latent variable with neutral condition, represented the moderating conditional valence category as demonstrated accurate by Henseler, Hubona, and Ray (2016) in their discussion on PLS path modeling. Multiple level categorical variables, in PLS, can be represented through the formation of representative dummy variables. A composite is then utilized representing all levels, minus one, which acts as the reference level, therefore dichotomizing the data. Categorical variables of this type should 'play the role of exogenous variable in a structural model' (Henseler, Hubona, Ray, 2016; Schuberth, Henseler, Dijkstra, 2018).

A weak effect size was indicated for the endogenous constructs of ECT (R^2=.14) by PV, meeting the Garson (2016) suggested cutoff. Moderation was found between the dependent construct PEU and PU with R^2=.54 (moderate effect), while the variance explained by exogenous constructs on PI was R^2=.39 (Streukens & Leroi-Werelds, 2016) see Table 3 and Figure 4.

Table 3: *Effect Size*

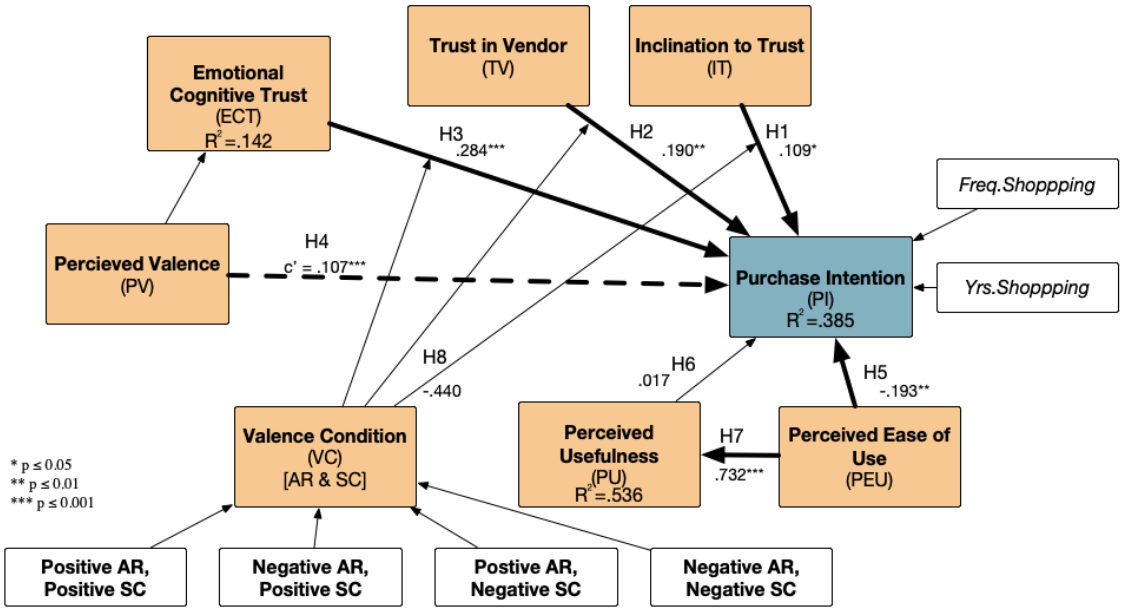
	R Square	R Square Adjusted
ECT	.14	.14
PI	.39	.36
PU	.54	.53

Cronbach's alpha measures, as noted in Table 2, show ECT variable α>.93. All values resulted as α>.76 level, greater than the suggested cutoff of α>.70. Composite Reliability greater than CR>.77 for all values, exceeding the suggested level of CR>.60. Additionally, the AVE exceeded .50 values reporting AVE>.54 except TV (AVE=.47).

SmartPLS 3.0's bootstrapping with J=5000 reported significant with t-values at t>1.96, p<.05 (Streukens & Leroi-Werelds, 2016).

H1: (t=2.05, p=.041) was supported, indicating a positive relationship between inclination to trust and increased purchase intentions.
H2: (t=2.83, p=.000) was supported, demonstrating the relationship between trust in vendor and purchase intentions to be positive. Increased trust in vendor results in increased buyer purchase intentions.
H3: (t=4.80, p=.000) was supported. A significant positive indication of relationship between greater emotional-cognitive trust and consumer purchase intentions was shown.
H4: (c'=.107, p=.000) was supported. Emotional-cognitive trust shows a mediating relationship between perceived valence and purchase intentions.
H5: (t=2.66, p=.008) was supported. Concurring with results from previous eTAM's research, a positive relationship was seen between perceived ease-of-use and purchase intentions.
H6: (t=.239, p=.811) demonstrated no support for the relationship between perceived usefulness and purchase intentions.
H7: (t=22.90, p=.000) shows support for a positive relationship between perceived ease-of-use and perceived usefulness, confirming past eTAM models.
H8: (t=.990, p=.322) was unsupported. No moderation between the trust relationship and purchase intentions was demonstrated.

Figure 4: *Structural Model Results*



Buyer experience in online shopping was assessed using frequency of shopping (Freq.shopping) per year and years shopping (Yrs.Shopping). Significant according to Spearman's rho (Rs=.149, p<.05), they demonstrate a strong relationship. Interestingly, the two buyer controls (see Appendix) did not show a direct influence on purchase intentions, yet strengthened the relationship between inclination trust and purchase intentions. Inclusion of the two buyer controls increased insights into shopper's behaviors and strengthened the overall predictive ability of the model. This supports others' findings regarding trust and purchase intentions, those with low trust levels would be expected to limit online purchase activities and demonstrate lower frequency of shopping and years shopping (Kim & Park, 2013; Cho & Sagynov, 2015; Guo, Wang, & Wu, 2020). The greater the inclination to trust, the more one would be expected to trust in online purchasing and actively shop online and to do so for a greater length of time (Yrs.Shopping) and more frequently (Freq.Shopping) (Kulviwat, Bruner, & Neelankavil, 2014). The two controls were only significant when used in combination. Those who have been shopping 8 years or more and purchase 15 or more times per year online are more likely to have inclination to trust influence their purchase intentions. A latent variable with neutral condition as the dummy reference level represented the moderating conditional valence category (Henseler, Hubona, & Ray, 2016; Schuberth, Henseler, Dijkstra, 2018).

DISCUSSION AND CONCLUSIONS

In an era where online purchasing continues to show growth, understanding diagnostic aspects of purchase intention formation is of greater importance to online vendors (Guo, Wang, & Wu, 2020). Information Diagnosticity offers greater insights into how consumers determine product purchase categorization. Electronic social sharing of product experiences impacts decision making within online sales. Extending Klopping and McKinney's (2016) eTAM to account for diagnostic criteria derived from eWOM customer reviews strengthens the predictive ability of the model.

The extended model confirms six of eight hypotheses, giving a clearer understanding of purchase intention formation. Greater trusts, represented by cognitive-emotional trust, inclination to trust, and trust in vendor, all were supported with positive relationships on purchase intentions.

As theoretically supported, a person's increased inclination to trust has a positive impact on purchase intentions, those with depressed intrinsic trust behaviors are not expected to risk online financial exchanges. Without the initial inclination to trust ecommerce, limited expectations of online shopping would be expected. Trust in the electronic vending platform and in the shared consumer reviews would be hard for anyone with unlikely inclination to trust (Cho & Sagynov, 2015; Kulviwat, Bruner, & Neelankavil, 2014; Guo, Wang, & Wu, 2020; Lee & Hong, 2019).

Trusting the ecommerce platform increases the likelihood for a consumer to purchase items. This research demonstrated that increased trust in vendors, specifically Amazon.com, increases the purchase intention formation. The trusting diagnostic criteria contributing to purchasing is dependent on believing the vendor is trustworthy, and is consistent with Information Diagnosticity. Trust in vendors can be generated by eWOM, previous experiences, and reputation. Increased trust increases the comfort of the consumer in taking a financial risk with a specific evendor (Cho & Sagynov, 2015). Increasing trust in online vendor transactions can include 'no risk' trail periods, ease returns, free shipping, and other risk mitigating options. Promoting a positive and trustworthy image online and in response to consumer reviews may also assist in trust generation.

Consistent with previous research on eTAM, the relationship between perceived ease-of-use and purchase intentions was supported (Klopping & McKinney, 2004). It is logical that the harder the platform is to use the less customers will complete transactions. With the wide selection of online vendors available, e-vendors with hard to use interfaces would attract fewer customers (Davis, Bagozzi, & Warshaw, 1989; Davis & Venkatesh, 1996; Klopping & McKinney, 2004; Guo, Wang, & Wu, 2020). Increase consumer traffic may be generated through the implementation of intuitive user interface, specifically product selection and purchasing. Additionally, online assistance in purchasing using friendly and trustworthy support interactions may increase consumer use comfort.

Perceived ease-of-use compliments the construct of perceived usefulness, as indicated in past eTAM research. The easier a technology is to use, the more useful the technology appears. Harder to use interfaces may cause frustration, decreasing the worth of the site to the user, a hard to use evendor will be less useful than an ease to use brick-and-mortar store. It is assumed that the effort expended to use an online shopping site should be less than traveling and shopping in person. Effort expended should be limited, increasing ease-of-use and perceived usefulness. Implementing simple use tutorials, offering overviews, and online assistance may increase ease-of-use perceptions and increasing perceived usefulness, thus giving a better experience for the effort expend (Davis & Venkatesh, 1996; Klopping & McKinney, 2004; Guo, Wang, & Wu, 2020). Useful websites are more likely to attract repeat customers.

Hypotheses 6 and 8, while unsupported, may show important findings. While inconsistent with previous findings, perceived usefulness was not supported as influencing purchase intentions. This could be a lack of variance in the participant base. The selection criteria of participants assumed Amazon patronage and users of Amazon's MTurk service. This population already assumes the website is useful, therefore skewing the results and limiting variance (Gurney, 2019). Perceived usefulness becomes a less influencing intention formation factor is the group already assumes usefulness. The homogeneity of the sample may be affecting this construct. Further research with a more diverse sample is suggested.

Strengthening the ecommerce technology acceptance model through the implementation of Information Diagnosticity allows for greater accuracy in assessing impacting criteria within eWOM customer reviews. Increasing the measurability of valence and trust elements present in online product pages, hosted on websites such as Amazon.com, allows for increase insights into purchase intention behaviors. Improved understanding of how diagnostic information available in online product pages and trusting elements influence ecommerce can facilitate improved vendor-customer interfaces. Information Diagnosticity extends eTAM to account for additional elements impacting purchase behaviors, improving the model's predictive abilities.

REFERENCES

Andrews, D., & Allen, A. (2016). Information form and level-of-analysis as moderators of the influence of information diagnosticity on consumer choice and purchase readiness. *Academy of Marketing Studies Journal, 20*, 42-65.

Animesh, A., Pinsonneault, A., Yang, S., & Oh, W. (2011). An odyssey into virtual worlds: exploring the impacts of technological and spatial environments on intention to purchase virtual products. *MIS Quarterly, 35*(3), 789-810.

Beldad, A. D., & Hegner, S. M. (2017). German Users' Willingness to Continue using a Fitness App: A Structural Equation Modeling Approach. *International Journal of Human-Computer Interaction*.

Chang, H., & Chen, S. (2008). The impact of online store environment cues on purchase intention: trust and perceived risk as a mediator. *Online Information Review, 32*(6), 818-841.

Chau, A. Y., & Banerjee, S. (2014). Developing a theory of diagnosticity for online reviews. *Proceedings of the International Multiconference of Engineers and Computer Scientists, 1*.

Cho, Y. C., & Sagynov, E. (2015). Exploring factors that affect usefulness, ease of use, trust, and purchase intention in the online environment. *International Journal of Management and Information Systems - First Quarter, 19*(1), 21-36.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management Science, 35*(8), 982.

Davis, F., & Venkatesh, V. (1996). A critical assessment of potential measurement biases in the technology acceptance model: three experiments. *International Journal of Human - Computer Studies, 45*, 19-45.

Dayton, E. (2020). Amazon Statistics You Should Know: Opportunities to Make the Most of America's Top Online Marketplace. Retrieved from Big Commerce: https://www.bigcommerce.com/blog/amazon-statistics/#amazon-everything-to-everybody

Dessel, P. V., Cone, J., Gast, A., & De Houwer, J. (2020). The impact of valenced verbal information on implicity and explicity evaluation: the role of information diagnosticity, primacy, and memory cueing. *Cognition & Emotion, 34*(1), 1-20.

Evers, E. R., & Lakens, D. (2014). Revisiting Tversky's diagnosticity principle. *Frontiers in Psychology, 5*, 1-13.

Fagerstrom, A., Pawar, S., Sigursson, V., & Foxall, G. R. (2017). That personal profile image might jeopardize your rental opportunity! On the relative impact of the seller's facial expressions upon buying behavior on Airbnb. *Computers in Human Behavior, 72*, 123-131.

Filieri, R. (2015). What makes online reviews helpful? A diagnosticity-adoption framework to explain informational and normative influences in e-WOM. *Journal of Business Research, 68*(6), 1261-1270.

Fogel, J., & Zachariah, S. (2017). Intentions to Use the Yelp Review Website and Purchase Behavior after Reading Reviews. *Journal of Theoretical and Applied Electronic Commerce Research, 12*(1), 53-67.

Gefen, D., Karahanna, E., & Straub, D. W. (2003). Trust and TAM in Online Shopping: An integrated Model. *MIS Quarterly, 27*(1), 51-90.

Ghasemaghaei, M. (2020). The role of positive and negative valence factors on the impact of bigness of data on big data analytics usage. *International Journal of Information Management, 50*, 395-404.

Guo, J., Wang, X., & Wu, Y. (2020). Positive emotion bias: Role of emotional content from online customer reviews in purchase decisions. *Journal of Retailing and Consumer Services, 52*, 101891.

Gurney, L. (2018). Information diagnosticity and purchase intentions in ecommerce. *ProQuest*.

Gurney, L., Eveland, J., & Guzman, I. (2019). What you say, I buy!: Information Diagnosticity and the Impact of Electronic Word-of-Mouth (eWOM) Consumer Reviews on Purchase Intention. *ACM SIGMIS Computers and People Research.* Nashville.

Hassanein, K., & Head, M. (2007). Manipulating perceived social presence through the web interface and its impact on attitude towards online shopping. *International Journal Human-Computer Studies, 65*, 689-708.

Henseler, J., Hubona, G., & Ray, P. A. (2016). Using PLS path modeling in new technology research: updated guidelines. *Industrial Management & Data Systems, 116*(1), 2-20.

IBM. (2018). Watson: Tone Analyzer Documentation. Retrieved from Tone Analyzer - API Reference | IBM Watson Developer Cloud.: https://tone-analyzer-demo.ng.bluemix.net/

Kim, S. & Park, H. (2013). Effects of various characteristics of social commerce (s-commerce) on consumers' trust and trust performance. International Journal of Information Management, *33*, 318-332.

Klopping, I. M., & McKinney, E. (2004). Extending the Technology Acceptance Model and the Task-Technology Fit Model to Consumer E-Commerce. *Information Technology, Learning, and Performance Journal, 22*(1), 35-48.

Koo, D. (2015). The strength of no tie relationship in an online recommendation focused on interactional effects of valence, tie strength, and type of service. *European Journal of Marketing, 49*(7/9), 1163-1183. Retrieved from European Journal of Marketing.

Kucukusta, D., Law, R., Besbes, A., & Legoherel, P. (2015). Re-examining perceived usefulness and ease of use in online booking. The case of Hong Kong online users. *International Journal of Contemporary Hospitality Management, 27*(2), 185-198.

Kulviwat, S., Bruner, G. C., & Neelankavil, J. P. (2014). Self-efficacy as an antecedent of cognition and affect in technology acceptance. *Journal of Consumer Marketing, 31*(3), 190-199.

Lee, H., Sun, P., Chen, T., & Jhu, Y. (2015). The effects of avatar on trust and purchase intention of female online consumer: consumer knowledge as a moderator. *International Journal of Electronic Commerce Studies, 6*(1), 99-118.

Lee, J., & Hong, I. B. (2019). Consumer's Electronic Word-of-Mouth Adoption: The Trust Transfer Perspective. *International Journal of Electronic Commerce, 23*(4), 595-627.

Lee, M., Kim, M., & Peng, W. (2013). Consumer reviews: reviewer avatar facial expression and review valence. *Internet Research, 23*(2), 116-132.

Liang, T., Li, X., Yang, C., & Wang, M. (2016). What in Consumer Reviews Affects the Sales of Mobile Apps: A Multifacet Sentiment Analysis Approach. *International Journal of Electronic Commerce, 20*(2), 236-260.

Lim, Y. J., Osman, A., Salahuddin, S. N., Romle, A. R., & Abdullah, S. (2016, October 5th & 6th). Factors Influencing Online Shopping Behavior: The Mediating Role of Purchase Intention. *7th International Economics and Business Management Conference, 35*, 401-410.

Mauri, A. G., & Minazzi, R. (2011). The impact of hotel reviews posted by guests on customers' purchase process and expectations.14th Toulon-Verona Conference on Organizational Excellence in Services (pp. 799-814). University of Alicante.

Menon, G. R. (1995). Behavioral frequency judgments: An accessibility-diagnosticity framework. *Journal of Consumer Research, 22*(2), 212–228.

Mortazavi, M., Esfidani, M. R., & Barzoki, A. S. (2014). Influencing VSN users' purchase intentions The roles of flow, trust and eWOM. *Journal of Research in Interactive Marketing, 8*(2), 2014.

Park, D., & Kim, S. (2008). The effects of consumer knowledge on message processing of electronic word-of-mouth via online consumer reviews. *Electronic Commerce Research and Applications, 7*, 399-410.

Phuong, T. T., & Vinh, T. T. (2017). Proposing an Extension of the Technology Acceptance Model to Explain Facebook User Acceptance of Facebook Event Page. *Asian Social Science, 13(*6).

Pothos, E. M., Barque-Duran, A., Yearsley, J. M., Trueblood, J. S., Busemeyer, J. R., & Hampton, J. A. (2015). Progress and current challenges with the quantum similarity model. *Front. Psychol, 6*(205).

Schuberth, F., Henseler, J., & Dijkstra, T. K. (2018). Partial least squares path modeling using ordinal categorical indicators. *Quality and Quantity, 52*(1), 9-35. doi:http://dx.doi.org.ezproxy.trident.edu:2048/10.1007/s11135-016-0401-7

Streukens, S., & Leroi-Werelds, S. (2016). Bootstrapping and PLS-SEM: A step-by-step guide to get more out of your bootstrap results. *European Management Journal.*

Text2Data. (2018, Jan.). Text Analytics and Sentiment Analysis. Retrieved from http://text2data.org/Demo

Watson: Tone Analyzer. (2017). Retrieved from Tone Analyzer - API Reference | IBM Watson Developer Cloud: https://www.ibm.com/watson/developercloud/tone-analyzer/api/v3/#introduction

Wen, J. L. (2020). The Interaction Effects of Online Reviews, Brand, and Price on Consumer Hotel Booking Decision Making. *Journal of Travel Research.*

Wu, P. F. (2013). In Search of Negativity Bias: An Empirical Study of Perceived Helpfulness of Online Reviews. *Psychology and Marketing, 30(11),* 971-984.

Yang, J., Sarathy, R., & Walsh, S. M. (2016). Do review valence and review volume impact consumers' purchase decisions as assumed? *Nankai Business Review International, 7(2),* 231-257.

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COMBATTING COVID-19 INFORMATION TECHNOLOGY STRESS: A FRAMEWORK OF MINDFULNESS & EMOTIONAL INTELLIGENCE STRATEGIES

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ABSTRACT

In today's COVID-19 business environment, many employees have been forced into a telework environment. However, teleworkers are expected to be information technology (IT) literate. This may not be the case for many new COVID-19 teleworkers. This paper argues that because today's teleworkers may be experiencing emotional work exhaustion/stress, strategies are needed to help employees of organizations cope with IT stress reduction. This paper suggests a preliminary framework that includes mindfulness and emotional intelligence (EI) strategies as a possible solution to aid organizations in COVID-19 employee IT stress reduction.

INTRODUCTION

Stress deriving from the use of technology is a sustained topic within academic literature (Atanasoff & Venable, 2017). Since the COVID-19 epidemic forced individuals to lean on technology to connect to their business operations, an intensification of prioritization of technical architecture has placed added pressure on an organization's technology departments, as well as the teleworkers themselves. The reliance on technology to communicate leads individuals in their self-reflection of the organization's tools and platforms, along with their technical skills and abilities in a telework environment. Technical stress, or to be more specific, technostress, is based on a psychosocial model (Salanova et al., 2013). Wang, Shu, and Tu (2008) define technostress as a "reflection of one's discomposure, fear, tenseness, and anxiety when one is learning and using computer technology directly or indirectly. That ultimately ends in psychological and emotional repulsion and prevents one from further learning or using computer technology" (p. 3004). According to De' et al. (2020), technostress is increasing in parallel to productivity as the digital workplace is more demanding with the addition of technical improvements and requirements of digital literacy. A preliminary framework to mitigate technostress using mindfulness and EI literature is explored.

MINDFULNESS

Mindfulness is the quality of an individual's bias-free mind, listening to inner guidance, and being neutral regarding others (Kabat-Zinn, 2003). The practice of Mindfulness goes back to ancient times and has its roots in all major religious traditions, including Buddhism, Christianity, Hinduism, Judaism, and Islam (Trousselard, et al., 2014). Thich Nhat Hanh is noted to most recently bring Eastern teachings to the West and began his work with the University of Massachusetts and Stamford University medical schools to teach mindfulness techniques to reduce stress (Tamdgidi, 2008). More recently, Hanh and his cohort taught mindfulness techniques to 20 major global Tech companies, including Google. Eckhart Tolle also worked with Google to teach mindfulness techniques in 2013. The basics of Mindfulness are the following (Hahn, 1999):

1) Understand that happiness lies in the present moment, not in the future or some economic well-being.
2) The present moment is where you connect with your highest good and intuition.
3) Connecting with your highest good or intuition comes through quieting your mind.
4) Quieting your mind is emptying it of your thoughts. STOP THINKING!
5) Learning to stop your thoughts can only happen through meditation and/or interacting with nature.
6) Meditation and/or nature provide the connection with our divinity that raises our consciousness and positive feelings.
7) This shift in consciousness or positive feelings dissipates negativity or the "free radicals" such as stress, anxiety, exhaustion, or the human battles of ego, judgment, and every day unkindnesses (to name a few).

Therefore, collectively, as more people are mindful, the high level of energy creates a community of practice, changing our consciousness, providing understanding between people, better communication, healing, and more energy for the person to enhance their productivity (Baer et al., 2008; Brown et al., 2007; Carmody, et al., 2008; Carson, et al., 2004; & Feldman et al., 2007).

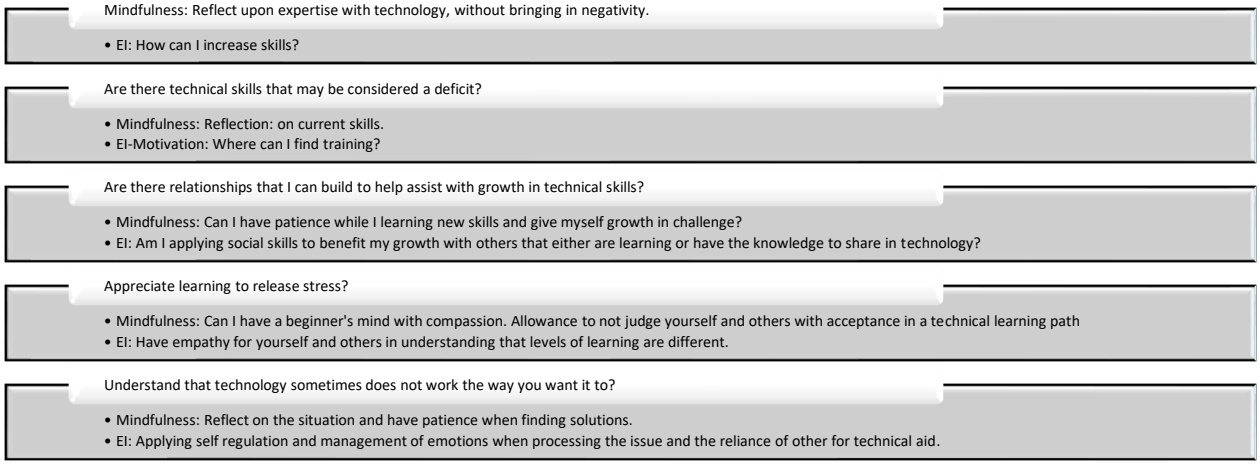
EMOTIONAL INTELLIGENCE/ MINDFULNESS CONNECTION

Emotional intelligence, as defined by Salovey and Mayer (1990), is "the subset of social intelligence that involves the ability to monitor one's own and others' feelings and emotions, to discriminate among them, and use this information to guide one's thinking and actions" (p.188). Thatcher et al. (2018) found that mindfulness was first noted by Salomon & Globerson (1987) in which the researchers assert that mindfulness may be related to "other constructs, be them personality inclinations (e.g., need for achievement), capabilities (e.g., mental capacity), or good strategy usage" (p.832). This assertion connects the use of mindfulness in the practice of EI. As Hendon et al. (2017) found, current EI literature focuses on management's use of EI but provides insight into individuals' communication enhancement with the use of EI traits. The study can be broadened to include mindfulness practice by the individual, which can be considered essential to an effective EI practice. This assertion is supported through Schutte and Malouff's (2011) research study, which found that higher levels of mindfulness lead to higher EI traits in an individual. Accordingly, the research found that EI does mediate the relationship between the individual and their well-being (Schutte & Malouff, 2011). To aid in the reduction of stress, communication and self-reflection practices are considered to be an individual's journey of growth. Furthermore, the use of mindfulness and EI to mitigate digital stress is essential for one's health and can help reduce stress through communication.

Research demonstrates that as mindfulness practices develop, people become better at coping with stress, grow in flexibility, and realize improved health benefits (Greeson, 2009). Developing greater compassion for others that includes the larger world and people in it, as well as seeking to understand connections with others (equanimity), reduces the egocentric world-view, improving positive response to oneself and others (Kristeller & Johnson, 2005). Being conscious in the present moment allows individuals to become self-aware of tendencies, they begin to consider their decision-making processes, stop first to reflect, and avoid future conflict (Drucker, 2005). Meditation practices, although difficult to begin due to the challenge of "being" versus "doing" or controlling your thoughts, leads to improved attention (Jha, et.al., 2010), as well as improved well-being (Brown & Ryan, 2003; Shapiro, et. al., 2008), and aids in developing interpersonal skills (Shapiro, et. al., 2011). Furthermore, Greeson (2009) states that mindfulness improves quality of life and health, leading to greater productivity and a balanced life.

EI and Mindfulness practices are cyclical. As mindfulness focuses on the whole self (mind, body, and spirit), EI seeks to allow the individual to explore their emotional self. An individual with a high emotional quotient (EQ) (ability to manage his/her emotions) needs to reflect and make changes in how others perceive his/her emotions and how they communicate their feelings, emotional patterns, and reactions when pushed outside of their comfort zone.

Figure 1



Concerning an individual's assessment and reflection of technostress, see Figure 1. for a preliminary framework of questions to ask yourself regarding your technical competency to mitigate technical stress. This framework incorporates both mindfulness and EI fundamentals. It is important to note that this is a cyclical process that requires the individual to be open and honest with him/her self in answering the questions to develop habits that will improve their overall reduction of technostress and well-being.

CONCLUSION

Understanding yourself is a common goal of both mindfulness and EI. The implication of using a blend of mindfulness and EI in everyday IT practices allows the individual to reflect in a structured manner and maneuver through daily stress and anxiety of work and life. Mindfulness quiets the mind for individuals to be aware of how their thoughts can make a difference in outcomes. It includes being aware of your emotions. EI allows for the awareness of self-regulation in emotional behaviors (Wamsler & Restoy, 2020). One limitation of this study is no preliminary learning as to the framework and its usefulness in dealing with technostress. Future research includes testing the framework and using the framework in a quantitative study to understand how the questions can benefit an individual when faced with technostress. This study's ultimate value is to incorporate mindfulness and EI principles in everyday life so that teleworkers can reduce stress and anxiety and improve their daily productivity.

REFERENCES

Atanasoff, L. & Venable, M. (2017). Technology and wellness: implications for career development and the workplace. *Career Planning & Adult Development Journal, 33*(1), 65–69.

Baer, R. A., Smith, G. T., Lykins, E., Button, D. Krietemeyer, J., Sauer, S…& Williams, J. M. (2008). Construct validity of the five-facet mindfulness questionnaire in meditating and non-mediating samples. *Assessment, 15,* 329-342.

Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology, 84(4),* 822-848.

Brown, K. W., Ryan, R. M., & Creswell, J. D. (2007). Addressing fundamental questions about mindfulness. *Psychology Inquiry, 18(4).* 272-281.

Carmody, J., Reed, G., Kristeller, J., & Merriam, P. (2008). Mindfulness, spirituality, and health-related symptoms. *Journal of Psychosomatic Research*, *64*(4). 393-403.

Carson, J. W., Carson, K. M., Gil, K. M., & Baucom, D. H. (2004). Mindfulness-based relationship enhancement. *Behavior Therapy, 35(3),* 471-494.

De', R., Pandey, N., & Pal, A. (2020). Impact of digital surge during the Covid-19 pandemic. A viewpoint on research and practice. *International Journal of Information Management*, *55*. https://doi.org/10.1016/j.ijinfomgt.2020.102171

Drucker, P. F. (2005). Managing oneself. *Harvard Business Review, 83(1),* 100-109.

Feldman, G., Hayes, A., Kumar, S., Greeson, J., & Laurenceau, J. P. (2007). Mindfulness and Emotion Regulation: The Development and Initial Validation of the Cognitive and Affective M Scale-Revised (CAMS-R). *Journal of Psychopathology and Behavioral Assessment, 29*(3), 177–190.

Greeson, J. M. (2009). Mindfulness research update: 2008, *Complementary Health Practice Review, 14(1),* 10-18.

Hahn, T. N. (1999). *The miracle of mindfulness: An introduction to the practice of meditation*. Beacon Press.

Hendon, M., Powell, L., & Wimmer, H. (2017). Emotional intelligence and communication levels in information technology professionals. Computers in Human Behavior, *71*, 165-171. doi: https:// doi.org/10.1016/j.chb.2017.01.048

Jha, A. P., Stanley, E. A., Kiyonaga, A., Wong, L., & Gelfand, L. (2010). Examining the protective effects of mindfulness training on working memory capacity and affective experience. *Emotion. 10(1),* 54-64.

Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: past, present, and future. *Clinical Psychology: Science and Practice, 10(2),* 144-156.

Kristeller, J. L., & Johnson, T. (2005). Cultivating loving kindness: A two-stage model of the effects of meditation on empathy, compassion, and altruism. *Zygon, 40(2),* 391-408.

Oppland, M. (2020, January 09). How Mindfulness can grow Emotional Intelligence. Positive Psychology.com. Retrieved from https://tinyurl.com/y6ytkbar

Salanova, M., Llorens, S., & Cifre, E. (2013). The dark side of technologies: Technostress among users of information and communication technologies. *International Journal of Psychology*, *48*(3), 422–436. https://doi.org/10.1080/00207594.2012.680460

Salomon, G., & Globerson, T. (1987). Skill may not be enough: The role of mindfulness in learning and transfer. *International Journal of Educational Research*, *11*(6), 623–637. https://doi.org/10.1016/0883-0355(87)90006-1

Salovey, P., & Mayer, J. D. (1990). Emotional intelligence. *Imagination, cognition and personality*, *9*(3), 185-211.

Schutte, N. S., & Malouff, J. M. (2011). Emotional intelligence mediates the relationship between mindfulness and subjective well-being. *Personality and Individual Differences*, *50*(7), 1116–1119. https://doi.org/10.1016/j.paid.2011.01.037

Shapiro, S. L., Brown, K. W., & Astin, J. (2011). Toward the integration of meditation into higher education: A review of research evidence. *Teachers College Record, 113(3),* 493-528.

Shapiro, S. L., Oman, D., Thoresen, C. E., Plante, T. G., & Flinders, T. (2008). Cultivating mindfulness: Effects on well-being. *Journal of Clinical Psychology, 64(7),* 840-862.

Tamdgidi, M. H. (2008). Editor's Note: Thich Nhat Han's Sociological Imagination. *Human Architecture Journal of Sociology of Self-Knowledge, 6(3),* Article 1.

Thatcher, J. B., Wright, R. T., Heshan Sun, Zagenczyk, T. J., & Klein, R. (2018). Mindfulness in Information Technology Use: Definitions, Distinctions, and a New Measure. *MIS Quarterly*, *42*(3), 831–847. https://doi.org/10.25300/MISQ/2018/11881

Trousselard, M., Steiler, D., Claverie, D., & Canini, F. (2014). The history of Mindfulness put to the test of current scientific data: Unresolved questions. *L'Encephale, 40,* 474-480.

Wang, K., Shu, Q., & Tu, Q. (2008).Technostress under different organizational environments: An empirical investigation. Computers in Human Behavior, *24*, 3002–3013

Wamsler, C., & Restoy, F. (2020). Emotional Intelligence and the Sustainable Development Goals: Supporting Peaceful, Just, and Inclusive Societies. Springer Nature Switzerland AG, 1–11. https://doi.org/10.1007/978-3-319-71066-2_123-1

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EFFECTIVENESS OF ONLINE COURSE ENGAGEMENT METHODS TO IMPROVE LEARNING OUTCOMES

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ABSTRACT

About 20% of undergraduate students were taking a distance education course in 2008 (Radford & Weko, 2011). By the fall of 2018, that percentage had increased to 35% (US Department of Education, 2018). Yet, as this trend continues, academic leaders remain skeptical of distance education efficacy. More evidence is needed to support online education methods resulting in adequate student learning outcomes. This study investigates factors of online engagement and learning outcomes for online students through an Ordinary Least Squares (OLS) regression analysis of an online course engagement rubric. The results demonstrate how online course instructors can encourage engagement and improve student performance outcomes in online pedagogies.

INTRODUCTION

Over a third of students now take a distance education course (US Department of Education, 2018). As online course offerings become more common, educators and administrators look for ways to gauge the effectiveness of online pedagogy. Given that only 29.1% of academic leaders reported that their faculty accepted the "value and legitimacy of online education" (Online Learning Consortium, 2016), there is a need for more evidence to demonstrate how online education can have the same "value and legitimacy" as classroom instruction. This study focuses on the well-documented effectiveness of student engagement in the classroom as applied in the online learning realm. It seeks to address how online courses can impart better student learning outcomes through approaches to engagement. To this end, an online engagement rubric was developed and implemented across five business courses to determine which approaches to engagement were most effective in improving student learning outcomes. The results will help educators and administrators to understand how engagement relates to outcomes in online education.

REVIEW OF LITERATURE

Defining Student Engagement

Hu and Kuh (2001) define engagement as: "quality of effort students themselves devote to educationally purposeful activities that contribute directly to desired outcomes." In pursuit of these outcomes, engagement encompasses several pedagogical factors. Moore's (1989) essential types of engagement interaction explain that engagement includes student-student, student-teacher and student-content interaction. Bandura et al. (1961, 1963) illustrated that students learn by observing others' behaviors. Vygotsky's "zone of proximal development" describes the difference between what students can perform by themselves and what they can perform with others (Vygotsky, 1978).

Models of engagement have helped to clarify its key components. Briggs, Sullivan, and Towler's (2005) measure of traditional classroom student engagement identified four factors of engagement: skills engagement (such as: keeping up with readings, putting forth effort); emotional engagement (such as: making the course interesting, applying it to their own lives); participation/interaction engagement (such as: having fun, participating actively in small group discussions); and performance engagement (such as: doing well on tests, getting a good grade) (Handelsman et al., 2005, p. 187). Engagement is also commonly categorized as behavioral (i.e. relating to behavioral norms), emotional (i.e. relating to affective interest, enjoyment, and sense of belonging) and cognitive (i.e. interest in learning and seeking to go beyond requirements) (Fredricks et al., 2004; Trowler, 2010). Groccia's (2018) model of student engagement involves doing, feeling and thinking with other students, in teaching, in learning, with the community, in research, and with faculty and staff.

Engagement relates to a student's experience with the social climate of the classroom and university. Students experience complex interactions with educational institutions with interrelated factors of self-efficacy, emotions, sense of belonging and wellbeing and these factors may impact student engagement outcomes including interest, enthusiasm, deep learning, self-regulation, participation, time and effort and interaction (Kahu & Nelson, 2018). Kahn (2014, 2017) suggests that there is a need to strengthen quality and breadth of social relations in higher education since the

scope of student engagement is beyond technical reasoning; instead, it relies on the social aspects of a learning environment where students must take responsibility for deliberative response in the face of uncertainty and pursuit of shared goals.

The Impact of Student Engagement

Engagement can lead to a range of positive learning outcomes. These outcomes include critical thinking, academic achievement, perseverance and student learning (Berger & Milem 1999; Carini et al., 2006; McClenney et.al., 2012; Pike et al., 2012). Kuh et al. (2008) used the National Survey on Student Engagement (NSSE) data as well as academic transcripts, merit aid, and ACT/SAT reports to conclude that student engagement has a positive, statistically significant effect on grades and persistence between the first and second years of study.

Students perceive that engagement has a significant impact on their success and satisfaction (Sadaf & Ahlgrim-Delzell, 2019; Fedynich, Bradley, & Bradley, 2015; Boozer & Simon, 2020; Witkowski & Cornell, 2015). Using the most recent version of the NSSE survey, Zilvinskis et al. (2017) found that student engagement was positively correlated with student self-reported learning gains. Richmond et al. (2015) found that student engagement was a significant predictor of student ratings of teaching and effectiveness, along with faculty-student rapport and use of humor.

Given the importance of engagement for student satisfaction and learning, several tools have been developed to measure student perceptions of its impact. The Higher Education Student Engagement Scale (HESES) has demonstrated that cognitive engagement, or intellectual inspiration and intrinsic motivation, is a key to academic success (Zhoc et al., 2019). Smallwood (2006) developed the Classroom Survey of Student Engagement (CLASSE) survey to measure student perceptions of engagement. The CLASSE survey has been used to determine student perceptions of engagement with course design (Reid, 2012; Ravenscroft & Luhanga, 2018). Handelsman et al. (2005) developed the *Student Course Engagement Questionnaire* (SCEQ) to study self-report measures of engagement, endorsement of self-theories, goal preferences and grades. Nasir et al. (2020) later modified the SCEQ survey for use in varied teaching settings including graduate-level and online courses.

Student Engagement & Online Learning

Student engagement is a key element for keeping students connected with an online course and, thus, with their learning (Dennen, Darabi, & Smith, 2007; Kehrwald, 2008; Robinson & Hullinger, 2008; Shea, Li, & Pickett, 2006; Swan, Shea, Fredericksen, Pickett, Pelz, & Maher, 2000). In a 2014 study, engagement in remote learning increased retention in online courses, influenced learning and higher order thinking, and suggested higher student satisfaction (Effects from Student Engagement Online, 2014).

Learning technology can influence student engagement via access to technology, usability, design, accessibility, technology choice, sense of community, supportiveness, and assessment (Bond & Bedenlier, 2019). Rashid and Ashghar (2016) found that students may be more engaged with better technology use and performance may improve with use of some specific types of technology such as social media. Digital games, web conferencing and Facebook can also be effective computer-based technology tools to encourage engagement within online learning courses (Schindler et al., 2017). Hussein et al. studied variables that predicted low engagement and found that "clicks" on course content, forums, subpages and homepages predicted whether a student would have low engagement (Hussein et al., 2018).

Using online learning technology, instructors can create interdisciplinary collaboration, accessible course materials, community of learning, discussions, and assessment methods to improve engagement in online course design (Kahn et al., 2017). This design can include both synchronous and asynchronous online components. A 2007 study at the University of Southern Mississippi found that both faculty and students perceived synchronous interactive online instruction (SIOI) as having equal effectiveness, suggesting that online course interaction can be perceived as effective as face-to-face when the format and engagement is similar (Ward, Peters, & Shelley, 2010). Martin and Deale (2012) also found that synchronous components of online pedagogy were effective for promoting student interaction and learning.

Researchers recommend creating online courses that encourage three characteristics: social presence, community, and meaningful interaction (Bigatel, Ragan, Kenan, May, & Redmond, 2012; Dow, 2008; Hill, Song, & West, 2009) The

Community of Inquiry model (CoI) discusses three "presences" that are necessary for an effective community of online learners: social presence, teaching presence, and cognitive presence (Akyol & Garrison, 2011; Akyol & Garrison, 2014; Annand, 2011; Garrison, 2007; Arbaugh, 2008; Garrison & Anderson, 2003; Garrison & Arbaugh, 2007; Shea & Bidjerano, 2010; Stodel, Thompson, & MacDonald, 2006). Teaching presence is about course design and organization, discourse facilitation, and direct instruction (Akyol & Garrison, 2014; Garrison, 2007). Cognitive presence includes the practical inquiry model, which moves students' thinking and discussion from a triggered event that makes them aware of some new idea, concept, or problem to exploration of the new information, integration of ideas, and finally to resolution of the problem (Akyol & Garrison, 2011). Thoughtfully designed course content, supportive instructors, and effective interactions between instructor-learner attribute to the effectiveness of online instruction (Sun & Chen, 2016).

Research based on the CoI has contributed several findings. First, teacher presence (especially facilitating discourse) has been found to interact with student interaction and affect online learning effectiveness (Arbaugh, 2005; Arbaugh & Benbunan-Fich, 2006). Second, student engagement in the instructional activities of the course improves learning (Arbaugh, 2000). Third, the teacher's instructional choices can influence students' use of deep approaches to learning and willingness to learn for its own sake (Garrison & Cleveland-Innes, 2005.) Fourth, the instructor's careful use of questions and guidance can produce higher levels of critical discourse in the course (Garrison & Cleveland-Innes, 2005). Finally, the use of the CoI to guide course redesign improves student learning outcomes (Swan et al., 2012).

Thus far, there are few published instruments for measuring distance course engagement. Roblyer and Wiencke's (2004) *Rubric for Assessing Interactive Qualities in Distance Courses* (RAIQDC) study is designed to gauge perceptions of others' engagement. Dixson's (2015) *Online Student Engagement scale* (OSE) studies student self-reports of engagement. Mehall (2020) used the RAIQDC rubric to develop a model for Purposeful Interpersonal Instruction (PII) which includes instructional, social and supportive interaction within the online realm.

There remains a need for further study to support the connection between specific approaches to engagement in online classes and student outcomes.

METHODS

This study adapts Dixson's 2015 *Online Student Engagement scale* (OSE) study and Moore's (1989) essential types of engagement to study observational learning behaviors and application learning behaviors in student-student, student-teacher and student-content interactions within the online course setting. For this study, observational learning behaviors included reading e-mails, reading discussion posts, and viewing content lectures and documents. Application learning behaviors observed included posting to forums, writing e-mails and taking quizzes. The primary variable of interest is the student performance in the online courses. This study aims to analyze the impact of student engagement in online classes on student outcomes. As a measure of student outcomes, both total points and exam grades are utilized, which are the dependent variables used in the study. Additionally, there are individual specific covariates that might affect student academic outcomes. These variables are included as control, as failing to control for these factors might lead to biased estimates. The following control variables are included in the model: gender, age, academic level (freshman-senior,) GPA, SAT scores upon entry to the university, and number of online credits taken at the university.

Existing data from five online courses (US Healthcare Systems, Current Healthcare Topics, Management Seminar, Strategic Leadership and Organizational Behavior) are used for this study, along with students' demographic and academic information, obtained from the university admissions office. A detailed online engagement rubric is utilized for the five online classes, which includes timeliness, posts read, reply posts and content accessed to determine overall engagement score. The engagement rubric complements a pedagogical approach aligned with established student course-specific engagement constructs and incentivizes students for associated positive course engagement behaviors. The engagement rubric is intended to provide a simple structure to compel online course participation beyond that of "checking the boxes for points" and course completion, while acknowledging certain limitations associated with high impact practices and online courses.

The engagement rubric is structured as follows. Students were given a weighted (10%) engagement grade for the course which was assessed through both observational and application learning behaviors. Observational learning behaviors were assessed for student-student and student-content interactions including quintile rankings for discussion

posts read, discussion post timelines (where 2 points would be given within the first two days, and 1 point with in the third day of the discussion forum start,) and the percent learning management course shell content accessed. (Learning management content included beginning of session introductions by the instructor, PowerPoints, supplemental readings and session wrap-ups). Application learning behaviors were assessed for student-student and student-teacher interactions including quintile rankings of substantive discussion forum reply posts to peer posts and responses within discussion forum posts to instructor or peer questions within 12 hours where points were deducted if the student failed to respond.

The study included a total of 101 undergraduate students in business-related degrees across the five online courses studied. Data was collected between the winter semester of 2015 and the summer semester of 2016. The major variables of interest include content, posts read, replies to posts and timeliness of responses.

Specifically, the model takes the following functional forms:

$$\text{Total Points}_i = a + b_1\text{content}_i + b_2\text{replies\_ratio\_of\_high}_i + b_3\text{read}_i + b_4\,\text{timeliness}_i + b_5 X_i + e_i \text{.....(1)}$$

$$\text{Exam Grades}_i = a + b_1\text{content}_i + b_2\text{replies\_ratio\_of\_high}_i + b_3\text{read}_i + b_4\,\text{timeliness}_i + b_5 X_i + e_i \text{.....(2)}$$

- *Control variables (X_i):* age, gender, class level SAT verbal, SAT math, GPA, number of online courses previously taken, and overall engagement scores
- *i* denotes individual observations (students in the data set)

Equations 1 and 2 are estimated using OLS regression analysis, where the estimated coefficients indicate the effects of engagement variables on the total points and exam grades, and hence, are a measure of student learning outcomes. Model 1 results reported in Table 1 below are estimated using Total Course Points as the dependent variable, and model 2 results in Table 2 below are estimated using Total Exam Points as the dependent variable.

RESULTS

The descriptive statistics for the data are reported in Table 1. Exam grades are consistent across the five courses, averaging a course grade B, except for HCAM 335. For the primary variables of interest in our study, the independent variables, vary across the courses for "Content" and "Replies Ratio". All other variables are consistent in their average values across all five courses. In terms of demographics, a majority of students are white, female (except in MGMT 454), with an average age of 22-23 years. In terms of the previous academic performance, students had an average GPA between 2.98 and 3.38, with the average SAT score mirroring those of typical students admitted to the university. A majority of students in the data set are business majors, are either a junior or senior, and have taken around five to nine online classes previously.

Table 1: ***Descriptive Statistics: Sample Means and Standard Deviations***

VARIABLE	ALL COURSES	MGMT 341	MGMT 454	HCAM 230	HCAM 335	MGMT 351
Dependent Variables						
Exam Grades	83.98 (11.32)	83.26 (7.02)	89.95 (9.21)	85.13 (7.44)	69.58 (9.59)	88.02 (11.46)
Total Points	319.91 (104.05)	355.92 (28.69)	470.99 (40.63)	276.12 (27.59)	121.53 (22.29)	345.22 (48.82)
Independent Variables						
Content	75.65 (30.64)	56.18 (36.68)	90.33 (23.85)	72.62 (32.64)	95 (16.66)	76.85 (24.74)
Replies Ratio	4.29 (13.70)	0.45 (0.26)	0.39 (0.31)	28.57 (26.59)	0.46 (0.29)	0.32 (0.24)
Read	0.47 (0.35)	0.49 (0.39)	0.73 (0.34)	0.50 (0.34)	0.51 (0.26)	0.32 (0.34)
Timeliness	0.42 (0.29)	0.35 (0.24)	0.58 (0.30)	0.31 (0.26)	0.52 (0.33)	0.40 (0.30)
Overall Engagement	0.56 (0.26)	0.56 (0.19)	0.69 (0.19)	0.55 (0.29)	0.72 (0.24)	0.45 (0.28)
Demographics						
Female (%)	62.38	50	33.33	78.57	73.33	69.44
Age	22.81 (3.95)	23.17 (3.57)	22.25 (1.42)	22.50 (4.50)	22.53 (5.82)	23 (3.80)
Ethnicity[1]						
White (%)	70.27	24	0	71.43	100	68.75
African American (%)	5.41	25	0	0	0	6.25
Asian (%)	24.32	50	100	28.57	0	25
Academic Aptitude						
GPA	3.12 (0.50)	2.95 (0.46)	3.14 (0.57)	3.05 (0.61)	3.38 (0.39)	3.15 (0.48)
SAT Verbal[2]	493.89 (49.52)	490.91 (51.66)	506 (24.08)	492.22 (59.11)	496 (51.03)	492.50 (51.44)
SAT Math	498.31 (60.03)	489.09 (66.55)	500 (71.06)	502.22 (87.58)	503 (36.22)	498.75 (55.19)
# Online Courses Taken	6.49 (3.65)	7.08 (3.68)	8.83 (4.82)	5.36 (2.02)	5.40 (3.11)	6.22 (3.65)
Class level[3]	3.63 (0.57)	3.93 (0.27)	4.00 (0.00)	3.44 (0.73)	3.38 (0.51)	3.56 (0.64)
Business Majors (%)	55.45	79.17	91.67	78.57	0	41.67
Transfer (%)	77.45	62.50	66.67	42.85	20.0	36.11
Observations	101	24	12	14	15	36

[1] Total observations with ethnicity information: 37
[2] SAT Verbal and SAT Math: 59 observations
[3] 1=Freshman; 2= Sophomore; 3=Junior; 4=Senior

In model 1, OLS estimates confirm a positive and statistically significant impact of "number of online courses taken previously" on total points for the courses (Table 2). An increase in the number of courses previously taken, on average, increased the final scores by six percentage points. This indicates that the previous experience of online courses better prepares students, and they are more likely to have a higher overall score in current courses.

Table 2: ***OLS Results: Total Points Dependent Variable***

Variable	Coefficient Estimates (1)	Coefficient Estimates (2)	Coefficient Estimates (3)
Constant	281.03 (34.87)	-43.89 (328.78)	32.96 (335.74)
Content	-0.15 (0.34)	-0.34 (0.52)	-0.19 (0.53)
Replies Ratio	-0.81 (0.75)	-0.43 (0.89)	-0.36 (0.89)
Read		-28.47 (54.91)	9.48 (65.04)
Timeliness	40.29 (35.69)	11.90 (51.15)	27.78 (53.12)
# Online Courses Taken	5.63** (2.81)	4.58 (5.47)	3.73 (5.51)
Female		-17.72 (34.19)	-19.41 (34.16)
Age		6.66 (11.06)	5.49 (11.09)
GPA		0.79 (40.02)	-6.55 (40.52)
SAT Verbal		0.44 (0.34)	0.43 (0.34)
SAT Math		0.15 (0.31)	0.14 (0.31)
Junior		-92.06 (75.13)	-87.45 (75.11)
Senior		-55.52 (73.28)	-57.92 (73.18)
Overall Engagement			-88.37 (81.57)
Observations	101	59	59
R-squared	0.06	0.16	0.19
F-statistic	1.64	0.77	0.80

Standard errors are in parenthesis. *** denotes significance at 1%, ** denotes significance at 5%, * denotes significance at 10%.
(1): without independent variable overall engagement grade
(2): with independent variable overall engagement grade

Model 2 OLS results confirm a positive and statistically significant impact of "timeliness" on exam grades for the courses (Table 3). An increase in the timeliness of responses, on average, increased the final scores by 7.7 percentage points. This means that those who posted closer to the discussion board start date performed better on course exams. In both models, there are no statistically significant impact of the demographic and other control variables on student outcomes (results reported in columns 2 and 3). The lack of statistical significance can be attributed to the limited sample size.

Table 3: ***OLS Results: Exam Grades Dependent Variable***

Variable	Coefficient Estimates (1)	Coefficient Estimates (2)	Coefficient Estimates (3)
Constant	79.83 (3.82)	81.08 (37.68)	82.85 (38.95)
Content	-0.01 (0.3)	-0.05 (0.06)	-0.05 (0.06)
Replies Ratio	0.08 (0.08)	0.06 (0.1)	0.06 (0.1)
Read		0.24 (6.29)	1.11 (7.55)
Timeliness	7.72*** (3.89)	4.91 (5.86)	5.27 (6.16)
# Online Courses Taken	0.32 (0.30)	0.25 (0.63)	0.23 (0.64)
Female		-0.21 (3.92)	-0.25 (3.96)
Age		0.27 (1.27)	0.24 (1.29)
GPA		-2.61 (4.59)	-2.77 (4.7)
SAT Verbal		0.02 (0.04)	0.02 (0.04)
SAT Math		0.002 (0.04)	0.002 (0.04)
Junior		-0.01 (8.6)	0.10 (8.7)
Senior		-4.17 (8.39)	-4.22 (8.49)
Overall Engagement			-2.03 (9.46)
Observations	101	59	59
R-squared	0.05	0.07	0.07
F-statistic	1.39	0.27	0.25

Standard errors are in parenthesis. *** denotes significance at 1%, ** denotes significance at 5%, *denotes significance at 10%.
(1): without demographic and other academic controls
(2): without independent variable overall engagement grade
(3): with independent variable overall engagement grade

Overall, one observational learning behavior is significantly impacted by student-content and student-student interactions. Students who posted to discussion forums in a timely manner performed better on course exams. The observational learning behavior of accessing learning management system course content and other related factors did not significantly impact exam or overall course performance.

Application learning behaviors also did not show an impact on exam grades or overall course performance. Student rankings for substantive content and the number of discussion forum replies did not impact exam or overall course performance.

DISCUSSION

The results of this study have implications for educators designing online course engagement strategies with the goal of impacting student outcomes. The variables that were analyzed in this study demonstrated the impact of differing approaches to engagement within online courses.

In this study, students who posted to discussion forums within 2-3 days of a topic being posted performed better on exams. This may have been attributed to the fact that more conscientious students were both more likely to post early and more likely to study for exams. Alternatively, or in addition, those who posted earlier may have been more likely to critically think about the discussion prompt, versus reading and repeating peers who had already responded. Both explanations are consistent with a higher level of engagement with course material. This study shows that encouraging conscientious behavior from students can help them to pay attention to and grasp material more thoroughly, and thus perform better on assessments.

This further demonstrates that student-student learning is an effective form of engagement. The quality and quantity of posts to other students did not have an impact on exam grades nor the overall course performance outcome (course grade). This demonstrates that it may not be as important for students to contribute to a discussion but to actively listen and learn from peers. This is consistent with studies from Bandura et al. (1961, 1963) which demonstrated that students learn by observing others' behaviors.

Similarly, students who replied in more quantity to others' posts and questions did not perform better on exams or in the course overall. This may reflect that the amount a student contributes to a discussion is not as important as that which a student absorbs from a discussion. Reading discussion posts and learning from peers, in other words, is more strongly connected to learning than telling peers what one already knows.

The quality of student post content also did not have a significant impact on exam grade or overall performance. This may be attributed to the fact that, even if a student spent a significant amount of time and thought on a post, if they were not keeping up on discussions throughout the semester, they may not have connected discussion responses to the learning objectives for that week's lessons.

The findings of this study have direct implications for the creation, development, and effectiveness of online instruction. If student engagement can be predicted, course instructors can be empowered to know when to follow up with students, determine which materials students are struggling with, adjust relevant materials and assessments based on student needs, thoughtfully contribute to class discussions, and redesign courses to integrate engagement activities (Hussein et al.,2018). Given the recent trend in increased offerings and enrollment of the web-based courses at the university, the results of the study provide valuable information to administrators, educators and prospective students as to how to improve student engagement to enhance student performance in online classes. When students are engaged, especially in peer-to-peer learning, performance outcomes in online courses improve.

STUDY LIMITATIONS & FUTURE RESEARCH

This study was limited in its sample size. Future studies could analyze these variables with additional courses and more students. Some variables were not available for this study. Collection of additional variables could improve this type of investigation in the future. In addition, the same instructor was used for all data collection. Future studies could incorporate additional instructors and disciplines.

Overall, further study is needed to connect online engagement methods with learning outcomes. Administrators and educators need empirical evidence to guide the development of meaningful online course pedagogies that engage students and support achievement of course objectives.

REFERENCES

Akyol, Zehra & Garrison, D. (2011). Assessing metacognition in an online community of inquiry. *The Internet and Higher Education, 14*, 183-190. 10.1016/j.iheduc.2011.01.005.

Ally, M. (2004). Foundations of educational theory for online learning. *Theory and Practice of Online Learning*, *1*.

Anderson, T. (2004). Teaching in an online learning context. In Anderson T., & Elloumi F. (Eds.) *Theory and Practice of Online Learning*. Athabasca, Canada: Athabasca University.

Annand, David. (2011). Social presence within the community of inquiry framework. *International Review of Research in Open and Distance Learning, 12*, 10.19173/irrodl.v12i5.924.

Arbaugh, J.B. (2000b) Virtual classroom versus physical classroom: An exploratory comparison of class discussion patterns and student learning in an asynchronous Intemet,based MBA course. *Journal of Management Education, 24*(2), 207-227.

Arbaugh, J. B. (2005). Is there an optimal design for on-line MBA courses? *Academy of Management Learning & Education, 4*, 135−149

Arbaugh. J.B. (2008.) Does the community of inquiry framework predict outcomes in online MBA courses? *International Review of Research in Open and Distance Learning*, *9*(2), 1-21

Arbaugh, J.B., & Benbunan-Finch, R. (2006). An investigation of epistemological and social dimensions of teaching in online learning environments. *Academy of Management Learning & Education, 5,* 435-447. 10.5465/AMLE.2006.23473204.

Ashcraft, D., Treadwell, T., & Kumar, V. (2008). Collaborative online learning: A constructivist example. *Journal of Online Learning and Teacher, 4*, 109-117.

Bandura, A., & Huston, A. C. (1961). Identification as a process of incidental learning. *The Journal of Abnormal and Social Psychology*, *63*(2), 311–318. https://doi.org/10.1037/h0040351

Bandura, A., Ross, D., & Ross, S. A. (1963). Vicarious reinforcement and imitative learning. *The Journal of Abnormal and Social Psychology*, *67*(6), 601–607. https://doi.org/10.1037/h0045550

Berger, J., & Milem, J. (1999). The role of student involvement and perceptions of integration in a causal model of student persistence. *Research in Higher Education - RES HIGH EDUC.*, *40*, 641-664. 10.1023/A:1018708813711.

Bigatel, P., Ragan, L., Kennan, S., May, J., & Redmond, B. (2012). The identification of competencies for online teaching success. *Journal of Asynchronous Learning Network. 16*, 59-78. 10.24059/olj.v16i1.215.

Bond, M., & Bedenlier, S. (2019). Facilitating student engagement through educational technology: Towards a conceptual framework. *Journal of Interactive Media in Education*, *2019*(1): 11, 1–14. DOI: https://doi.org/10.5334/jime.528

Carini, R., Kuh, G., & Klein, S. (2006). student engagement and student learning: testing the linkages*. *Research in Higher Education, 47*(1), 1–32. https://doi-org.proxy-sru.klnpa.org/10.1007/s11162-005-8150-9

Dennen, V., Darabi, A., & Smith, L. (2007). Instructor-Learner Interaction in Online Courses: The relative perceived importance of particular instructor actions on performance and satisfaction. *Distance Education. 28*, 65-79. 10.1080/01587910701305319.

Effects from student engagement online. (2014). Association for the Study of Higher Education (*ASHE) Higher Education Report, 40*(6), 67-73. doi:10.1002/aehe.20018

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: potential of the concept, state of the evidence. *Review of Educational Research, 74*(1), 59–109. https://doi.org/10.3102/00346543074001059

Garrison, D. (2007). Online community of inquiry review: Social, cognitive, and teaching presence issues. *Journal of Asynchronous Learning Networks. 11*. 10.24059/olj.v11i1.1737.

Garrison, D. & Akyol, Z. (2014). Toward the development of a metacognition construct for communities of inquiry. *The Internet and Higher Education. 17*, 84–89. 10.1016/j.iheduc.2012.11.005.

Garrison, D. R., & Anderson, T. (2003). *E-Learning in the 21st century: A framework for research and practice*. London: Routledge/Falmer. doi:10.4324/9780203166093

Garrison, D. R., & Arbaugh, J.B. (2007). Researching the community of inquiry framework: Review, issues, and future directions. *Internet and Higher Education. 10*, 157-172.

Garrison, D. & Cleveland-Innes, M. (2005). facilitating cognitive presence in online learning: Interaction is not enough. *The American Journal of Distance Education. 19*. 133-148. 10.1207/s15389286ajde1903_2.

Groccia, J. E. (2018). What is student engagement? *New Directions for Teaching & Learning*, *2018*(154), 11–20. https://doi-org.proxy-sru.klnpa.org/10.1002/tl.20287

Handelsman, M., Briggs, W., Sullivan, N., & Towler, A. (2005). A measure of college student course engagement. *The Journal of Educational Research, 98*(3), 184-192, DOI: 10.3200/JOER.98.3.184-192

Hill, J. R., Song, L., & West, R. E. (2009) Social learning theory and web-based learning environments: A review of research and discussion of implications. *American Journal of Distance Education, 23*(2), 88-103, DOI: 10.1080/08923640902857713

Hussain, M., Zhu, W., Zhang, W., & Abidi, S. M. R. (2018). Student engagement predictions in an e-learning system and their impact on student course assessment scores. *Computational Intelligence and Neuroscience*, 2018, 6347186. https://doi-org.proxy-sru.klnpa.org/10.1155/2018/6347186

Hrastinski, S. (2009). A theory of online learning as online participation. *Computers & Education, 52*, 78-82. doi:10.1016/j.compedu.2008.06.009

Kahn, P. E. (2014). Theorising student engagement in higher education. *British Educational Research Journal, 40*(6), 1005–1018. https://doi-org.proxy-sru.klnpa.org/10.1002/berj.3121

Kahn, P. Higher education policy on student engagement: Thinking outside the box. *High Educ Policy 30*, 53–68 (2017). https://doi.org/10.1057/s41307-016-0031-7

Ella R. K., & Karen Nelson. (2018). Student engagement in the educational interface: understanding the mechanisms of student success. *Higher Education Research & Development, 37*(1), 58-71, DOI: 10.1080/07294360.2017.1344197

Kehrwald, B. (2008). Understanding social presence in text-based online learning environments. *Distance Education - DISTANCE EDUC. 29*. 89-106. 10.1080/01587910802004860.

Kuh, G. D. (2009). The national survey of student engagement: Conceptual and empirical foundations. *New Directions for Institutional Research*, *2009*(141), 5–20. https://doi.org/10.1002/ir.283

Kuh, G. D., Cruce, T. M., Shoup, R., Kinzie, J., & Gonyea, R. M. (2008). Unmasking the effects of student engagement on first-year college grades and persistence. *Journal of Higher Education, 79*(5), 540-563. https://doi.org/10.1353/jhe.0.0019

McClenney, K., Marti, C. & Adkins, C. (2012). Student engagement and student outcomes: Key findings from "CCSSE" validation research. *Community College Survey of Student Engagement.*

Martin, F., Parker, M. A., & Deale, D. F. (2012). examining interactivity in synchronous Virtual classrooms. *International Review of Research in Open and Distance Learning, 13*(3), 227–261.

Mehall, S. (2020). Purposeful interpersonal interaction in online learning: What is it and how is it measured? *Online Learning, 24*(1), 182–204. https://doi-org.proxy-sru.klnpa.org/10.24059/olj.v24i1.2002

Moore, Michael. (1989). Three types of interaction. *American Journal of Distance Education. 3*. 1-7. 10.1080/08923648909526659.

Nasir, M. A. M., Janikowski, T., Guyker, W., & Wang, C. C. (2020). Modifying the student course engagement questionnaire for use with online courses. *Journal of Educators Online, 17*(1).

Online Learning Consortium. (2016, Februrary 9). Babson study: Distance education enrollment growth continues. *Online Learning Consortium: In the News*. https://onlinelearningconsortium.org//news_item/babson-study-distance-education-enrollment-growth-continues-2

Pike, G., Smart, J., & Ethington, C. (2012). The mediating effects of student engagement on the relationships between academic disciplines and learning outcomes: An extension of Holland's Theory. *Research in Higher Education, 53*(5), 550–575. https://doi-org.proxy-sru.klnpa.org/10.1007/s11162-011-9239-y

Radford, A., & Weko, T. (2011). Learning at a distance: Undergraduate enrollment in distance education courses and degree programs. Stats in brief. *U.S. Department of Education*. Institute for Education Sciences: National Center for Education Statistics. https://nces.ed.gov/pubs2012/2012154.pdf

Rashid, T., & Muhammad Asghar, H. (2016). Technology use, self-directed learning, student engagement and academic performance: Examining the interrelations. *Computers in Human Behavior, 63*, 604–612. https://doi-org.proxy-sru.klnpa.org/10.1016/j.chb.2016.05.084

Ravenscroft, B., & Luhanga, U. (2018). Enhancing student engagement through an institutional blended learning initiative: A case study. *Teaching & Learning Inquiry, 6*(2), 97–114. https://doi-org.proxy-sru.klnpa.org/10.20343/teachlearninqu.6.2.8

Richmond, A. S., Berglund, M. B., Epelbaum, V. B., & Klein, E. M. (2015). $a + (b_1)$ professor–student rapport + (b_2) humor + (b_3) student engagement = $(\hat{Y})$ student ratings of instructors. *Teaching of Psychology, 42*(2), 119–125. https://doi-org.proxy-sru.klnpa.org/10.1177/0098628315569924

Robinson, C.C., & Hullinger, H. (2008) New benchmarks in higher education: student engagement in online learning. *Journal of Education for Business, 84*:2, 101-109, DOI: 10.3200/JOEB.84.2.101-109

Schindler, L.A., Burkholder, G.J., Morad, O.A. et al. (2017). Computer-based technology and student engagement: A critical review of the literature. *Int J Educ Technol High Educ 14*, 25. https://doi.org/10.1186/s41239-017-0063-0

Shea, P., & Bidjerano, T. (2010). Learning presence: Towards a theory of self-efficacy, self-regulation, and the development of a communities of inquiry in online and blended learning environments. *Computers & Education, 55*(4), 1721–1731. https://doi.org/10.1016/j.compedu.2010.07.017

Shea, P., Li, C., & Pickett, A. (2006). A study of teaching presence and student sense of learning community in fully online and web-enhanced college course. *The Internet and Higher Education. 9,* 175-190. 10.1016/j.iheduc.2006.06.005.

Stodel, E., Thompson, T. L., & Macdonald, C. (2006). Learners' perspectives on what is missing from online learning: interpretations through the community of inquiry framework. *International Review of Research in Open and Distance Learning, 7,* 10.19173/irrodl.v7i3.325.

Sun, A., & Chen, X. (2016). Online education and its effective practice: A research review. *Journal of Information Technology Education: Research, 15*, 157-190

Swan, K., Shea, P., Fredericksen, E., Pickett, A., Pelz, W., & Maher, G. (2000). Building knowledge building communities: consistency, contact and communication in the virtual classroom. *Journal of Educational Computing Research, 23*(4), 359. Retrieved July 11, 2020 from https://www.learntechlib.org/p/91328/.

Trowler, V. (2010). *Student engagement literature review*. York: Higher Education Academy.

U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Spring 2019, Fall Enrollment component.

Vygotsky, L.S. (1978). *Mind in Society*. Cambridge, MA: Harvard University Press.

Ward, M. E., Peters, G., & Shelley, K. (2010). Student and faculty perceptions of the quality of online learning experiences. *International Review of Research in Open and Distance Learning*, *11*(3), 57–77.

Witkowski, P., & Cornell, T. (2015). An investigation into student engagement in higher education classrooms. *InSight: A Journal of Scholarly Teaching*, *10*, 56–67.

Woo, Y., & Reeves, T. (2007). Meaningful interaction in web-based learning: A social constructivist interpretation. *The Internet and Higher Education. 10*, 15-25. 10.1016/j.iheduc.2006.10.005

Zhoc, K. C. H., Webster, B. J., King, R. B., Li, J. C. H., & Chung, T. S. H. (2019). Higher Education Student Engagement Scale (HESES): Development and Psychometric Evidence. *Research in Higher Education, 60*(2), 219–244. https://doi-org.proxy-sru.klnpa.org/10.1007/s11162-018-9510-6

Zilvinskis, J., Masseria, A., & Pike, G. (2017). Student Engagement and Student Learning: Examining the Convergent and Discriminant Validity of the Revised National Survey of Student Engagement. *Research in Higher Education, 58*(8), 880–903. https://doi-org.proxy-sru.klnpa.org/10.1007/s11162-017-9450-6

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ANALYSIS OF MACHINE LEARNING TECHNIQUES FOR DETECTING MALICIOUS PDF FILES USING WEKA

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ABSTRACT

The expansion of cloud and connected software and hardware has increased the attack surface of the modern enterprise. The growth in quantity and quality have led to greater possibilities of system vulnerabilities leading to exploits. One of the threat vectors attackers use is embedding malware to Portable Document Format (PDF) files. The popularity and flexibility of these file formats have made PDFs an ideal target for unaware users. Malicious PDFs contain executable code used by attackers to steal company information or disrupt normal business operations. Adobe Acrobat and Reader users can view, create, manipulate, print, and manage files in PDFs shared hence increased risk. The National Technology Security Coalition report (2020) shows that 68% of data breaches occurred through email and 5% successful attacks through PDF files. In 2019, CVE recorded 17,306 software vulnerabilities on the Adobe Acrobat PDF reader. These software vulnerabilities on Adobe Acrobat PDF may lead to unauthorized users controlling the system, resulting in malicious programs, unauthorized access, and confidential data modification. The attacker may also delete data or create user accounts undetected. This study seeks to; identify threats, detect, classify, and create awareness of PDF malware on emails. This paper will present and compare different WEKA machine learning algorithms in malicious PDF detection and propose the best classifier from the analyzed algorithms.

INTRODUCTION

Digital commerce relies on sharing information and documents; in 2019, users opened over 250 billion PDF files, according to Adobe Fast Facts (2020). Around 8 billion Fortune 100 companies depend on the Adobe electronic signature to validate transactions over the internet from the statistics.

Historically, attackers would use executable files to attack computer systems. However, with the growth of email use in businesses, attackers have shifted their focus to using email to spread malware (Singh, 2016). For instance, most people interact with non-executable files such as Microsoft Word files, PDFs, excel sheets, and photos mostly shared via email for communication purposes. According to Singh (2016), computer users presume that non-executable file formats such as PDFs are secure and prevalent, thus assuming virus scanners and Advanced Threat Protection (ATP) are adequate to ascertain safety. However, attackers are now using PDF files and embedding them with malware that is difficult to detect and result in data breaches and computer harm.

Portable Document Format (PDF), a standard of ISO, is now the most popular file format in most offices today (Torres and Santos, 2018). PDF is a product of Adobe Systems launched in 1992 to enhance digital file-sharing and comfortable viewing and printing of the shared documents ("What is a PDF? Portable Document Format | Adobe Acrobat DC", 2020). PDFs are convenient and run on different platforms allowing the free exchange of files regardless of device or operating system. These files are easy to use, provide a method to exchange files and images, and offer various content management tools to facilitate information sharing. According to Kuo, Hsu, & Yang (2015), the files have application programming interfaces (APIs) that enhance user experience. For instance, the PDF has APIs that remind the user of the time or provide options to fill in a PDF. Although APIs are convenient for users, they have vulnerabilities that can make hackers modify the features of a PDF (Bhuiyan, 2018). The attacker can embed malware in attractive PDF files and target unaware PDF users to open the files.

CVE-2020-6398 exhibits a vulnerability in the Google Chrome PDFium, which allows an attacker to use uninitialized PDF resources to execute malware. CVE -2020-6112 exposes a vulnerability in the JPEG2000 Nitro Pro software, where an attacker can embed malicious code in an image inside a PDF file targeting an unaware user. When the user opens the data on the initializing tiles, the Nitro Pro application miscalculates the pointer on the tile resulting in memory errors ("CVE -Common Vulnerabilities and Exposures (CVE)," 2020).

In 2020, another software vulnerability was found in the Okular before 1.10.0 that required no user manipulation of a PDF for malicious code to execute. Attackers have also utilized the vulnerability in the PDF code of Nitro Pro 13.9.1.155 to execute malicious code remotely. According to CVE-2020-6074, attackers send malicious PDF files to victims, which triggers malware execution in the PDF parser of Nitro Pro 13.9.1.155. The severity of the attack is high

and can cause systems to crash after establishing a use after free errors. CVE-2020-10904 shows exploitation of the Foxit PhantomPDF 9.7.1.29511 in procuring a remote attack to a system when a user opens a corrupted PDF file ("CVE -Common Vulnerabilities and Exposures (CVE)," 2020). The attackers embed an executable code on the PDF's U3D object then send the file to an unaware user (NVD - Statistics, 2020). If the user fails to validate the source of the file and opens the PDF file, the attacker executes the code, which results in the crash of a program due to writing past the end of the PDF object.

This paper involves analyzing different machine learning classification techniques to determine whether a PDF file is malicious or clean. Machine learning classification consists of the analysis of PDF files based on its features. The main objective is to determine if the PDFs have an embedded object or not. The dataset used in this study contains multiple PDF files with different features classified using WEKA, a data mining software. Waikato Environment for Knowledge Analysis (WEKA) is an open-source software developed for data mining in various fields like education, research, etc. (bin Othman & Yau, 2007). The report consists of the analysis and comparison of NaiveBayes, BayesNet, J48, RandomForest, and Logistic Regression algorithms.

NaiveBayes is a classifier that uses Bayesian methods to form simplified networks depending on past probabilities (Van der Heide et al., 2019). The technique relies on the independence between the input variables and the output variables to produce results. Therefore, the input variables and the output variables contribute equally but independently to the computation's final product (Ting & Tsang, 2018).

The BayesNet classifier also uses Bayesian Network to predict the outcome of an analysis. The technique works well in datasets with complexity and where a change in one variable changes another variable. The classification involves the computation of probability distributions and the development of a directed acyclic graph where a variable is regarded as a node (Özdemir, Yavuz & Dael, 2019.)

Random Forest is a classifier that uses decision trees to predict the outcome. Each tree forms a subset of the training sample (Van der Heide et al., 2019), and the classification only runs once all the trees have been constructed. The results produced by this classifier are a summation of the predictions made by all the trees. The classifier has an advantage in completing data computation on a dataset with missing attributes (Huljanah et al. 2019).

J48 is also a tree-based algorithm. This algorithm uses decision tree methods that have leaves and branches. The result is based on the many outcomes from the leaves and branches computation (Özdemir, Yavuz & Dael, 2019).

The Logistic Regression is a linear classifier that shows the relationship between a dependent and an independent variable. The technique uses a logistic function to estimate the probability between the variables. The classifier is based on probability, and the results are represented in a linear form (Khairunnahar et al., 2019)

The Zero R algorithm is a simple classification method that uses algebraic expressions to categorize groups of data. This algorithm ignores all predictors to nominal and numeric data (Kaur & Singh, 2019). The Xero algorithm was the base algorithm for this study. The algorithms were evaluated, and the results were presented in a table. The outcome of the analysis will help identify a potential classifier that will predict malicious PDF files from the email that may harm computer systems.

Classification involves machine learning by using existing features. The dataset studied was extracted from GitHub, a platform for software developers to share programming codes and information. The dataset extracted on May, 5th 2020, has a total of 19,986 PDF files. From the dataset, 10,981 malicious PDF files, and 9,007 clean files. The data was selected because the variables are PDF attributes that attackers use to embed malicious codes. The sample data was collected by Rajeshwaran (2019) for machine learning and data analysis projects.

This study aimed to understand the PDF structure, explore different algorithms used for classification, and propose the best classifier for detecting malicious PDF Files. The experiment was limited to five algorithms present in WEKA; therefore, additional comparisons may have been better suited for detecting malicious PDFs.

This paper is organized as follows: Section 2 presents the background of the study. Section 3 describes the methodology used in the research, and section 4 outlines the results/findings/discussion from the experiment. Section 5 describes the conclusions made from the experiment.

The PDF basic structure includes the PDF header, the PDF body, the cross-reference table, and the trailer. The sections are static. The PDF header contains the PDF version, and the PDF body has the objects such as the font, length, filter, and in some cases, animations, and security objects (Torress & Santos, 2018). The cross-reference table (Xref) contains the pointers to all the objects in the PDF file, which helps the user locate all the files' contents on different pages. The trailer is the last section of the PDF basic structure that contains the EOF pointer, which refers to the cross-reference table. The trailer helps the user to find and locate the contents of the PDF file.

Figure 1: Sample of the PDF structure Source *http://infosecinstitute.com*.

BACKGROUND

Previous studies have proved that machine learning is a valuable tool in medicine, education, and research (bin Othman & Yau, 2007). Machine learning techniques involve developing models without prior knowledge of the variables (Van der Heide et al., 2019). One-way machine learning has been used in cybersecurity is to develop models to detect PDF malware. PDF files are popularly used for communication in digital businesses (Zhang, 2018). PDF files shared over emails include articles, research papers, business reports, and electronic receipts (Zhang, 2018). These file formats are popular because of their flexibility and acceptability.

Recent CVE reports show that PDF files have an API vulnerability that has made them a popular attack vector (CVE -Common Vulnerabilities and Exposures (CVE)," 2020). The attackers embed an executable code on PDF files that result in massive data breaches and considerable damages to computer systems ((NVD - Statistics, 2020). According to Torres & Santos (2018), traditional antivirus and sandboxes are not sufficient to detect such malicious PDFs because they have high false positives and negative rates.

Machine learning techniques have the potential to complement traditional methods for detecting malicious PDFs. Various machine learning algorithms can develop an accurate and versatile model to detect malicious PDF files from emails. However, it is difficult to determine the most accurate and most versatile algorithm in WEKA because different classifiers use different techniques to predict the outcome based on the specified variables (Beaugnon & Chifflier, 2018). Furthermore, different classifiers have specific attributes that may make them suitable to study malicious PDF files.

Three WEKA algorithms proposed as competitive classifiers for this study are Random Forest, Naïve Bayes, and BayesNet. RandomForest is a tree-based classifier that uses cross-validation to analyze data (Smutz & Stavrou, 2018). The classifier extracts the PDF file objects that run through the tree before providing an evaluation. Naïve Bayes and BayesNet use the Bayesian theory to classify based on PDF attributes such as the heap spray, JavaScript syntax, and shellcode (Cheng et al., 2012). Logical regression is a traditional technique that uses linear modeling to predict the outcome. Despite the algorithm being superior in providing linear models, logical regression cannot analyze data with missing entries (Van der Heide et al., 2019). We shall study the accuracy and potential of RandomForest, Naïve Bayes, BayesNet, in detecting malicious PDFs and compare the accuracy with traditional classifiers like Logical Regression and Zero R.

METHODOLOGY

For this study, a dataset was extracted from the GitHub software, a platform where software developers interact and share ideas. The dataset has a total of 19,986 PDF files. Ten thousand nine hundred eighty-one are malicious files, while 9,007 files are clean. The attributes used include the PDF components obj, endobj, stream, endstream, Xref, trailer, page, encrypt, JS, and JavaScript code. Other features analyzed include the AA, openaction, startxref,acroform, JBIG2Decode, rich media, launch, embedded file, XFA, and colors. The dataset had no errors and null values.

The data mining process involved using the open-source software WEKA. WEKA is a tool for knowledge analysis that has multiple machine learning algorithms for data analysis. The software is necessary to develop models in different sectors, such as bioinformatics, education, and medicine. This study involves using an algorithm efficient in cybersecurity (bin Othman & Yau, 2007). The classification algorithms utilized in this paper include NaivesBayes and BayesNet, which are probabilistic classifiers. Other classifiers used include tree classifiers such as the J48 and RandomForest, and Logistic Regression, a supervised algorithm based on the variables. The Xero was used as a base algorithm to compare the rest of the models.

The data was sorted and prepared for mining. The dataset contained attributes required for analysis, and no attribute was excluded from the study. The data were tabulated, as shown in Figure 3. The attributes analyzed include the PDF components obj, endobj, stream, Xref, trailer, etc. (Figure 3). All the attributes had numerical data; therefore, no separation was required. The PDF files were then classified as malicious or not malicious based on the components. Malicious files were classified as “yes,” and clean files were classified as “no.”

endstream	xref	trailer	startxref	Page	Encrypt	ObjStm	JS	Javascript	Malicious
16	2	2	2	3	0	0	0	0	no
2	0	1	1	0	0	0	1	2	yes
3	1	1	1	1	0	0	1	2	yes
2	1	1	1	1	0	0	1	2	yes

Figure 3: Sample of malicious PDF dataset

This study evaluates different machine learning techniques and proposes a model that can detect malicious PDF files accurately. The analysis will give us a perspective on how machine learning techniques can determine malicious files and clean files. The research involved analyzing and comparing five different machine learning models and selecting the best classifier from the outcome. The techniques involve two probabilistic classifiers, two tree classifiers, and one classifier based on x and y variables. The algorithms were selected to explore different types of classifiers according to the aims of the research.

For this paper, the algorithms used include NaiveBayes, BayesNet, J48, RandomForest, and Logistic Regression. The Xero was the base algorithm for the analysis and comparisons.

RESULTS

The evaluation involved different classification methods, i.e., NaiveBayes, BayesNet, J48, RandomForest, Logistic Regression, and Xero. In this study, WEKA was used to classify the malicious PDF dataset. 30% of the data was used for training, and 70% was used for testing.

The classifiers analyzed the data using specific PDF features for easy evaluation. As shown in Table 1, the first results tabulated include the correctly classified instances and its percentage, the incorrectly classified instances and its percentage, the Kappa statistic, and the time in seconds that the model took to complete the classification. Table 2 shows the error analysis, which summarizes the mean absolute error, the relative absolute error, the root mean squared error and each algorithm's root-relative error. Table 3 summarizes the accuracy of each algorithm using the true positive and false positive. Figures 5 and 6 show the accuracy of each algorithm based on the correctly classified instances and incorrectly classified instances, and error analysis, respectively.

Table 1: Testing results

Algorithm	*Correctly Classified% (No. of instances)*	*Incorrectly classified % (No of instances)*	*Kappa Statistic*	*Time taken (s)*
NaiveBayes	98.519 (19,690)	1.481 (296)	0.9701	0.34
BayesNet	98.6591(19,718)	1.3409 (268)	0.973	0.93
J48	99.6898 (19,924)	0.3102 (62)	0.9937	2.03
RandomForest	99.8449 (19,955)	0.1551 (31)	0.9969	7.36
Logistic Regression	99.5297 (19,892)	0.4703 (94)	0.9905	1.7
ZeroR	54.93 (10,980)	45.06 (9,006)	0	0.03

Table 2: Error analysis

Algorithm	*Mean Absolute Error*	*Root Mean Squared Error*	*Relative absolute error(%)*	*Root Relative squared error(%)*
NaiveBayes	0.0147	0.1139	2.9738	22.8985
BayesNet	0.0135	0.1132	2.7334	22.7418
J48	0.0039	0.054	0.7806	10.95
RandomForest	0.0032	0.0355	0.6535	7.1429
Logistic Regression	0.0077	0.0628	1.5647	12.6302
Xero	0.4951	0.4976	100	100

Table 3: True Positive and False Positive analysis

Algorithm	*TP Rate*	*FP Rate*
NaiveBayes	**0.978**	**0.009**
BayesNet	**1.0**	**0.024**
J48	**0.997**	**0.003**
RandomForest	**0.999**	**0.002**
Logistic Regression	**0.998**	**0.007**
Xero	**0.00**	**0.00**

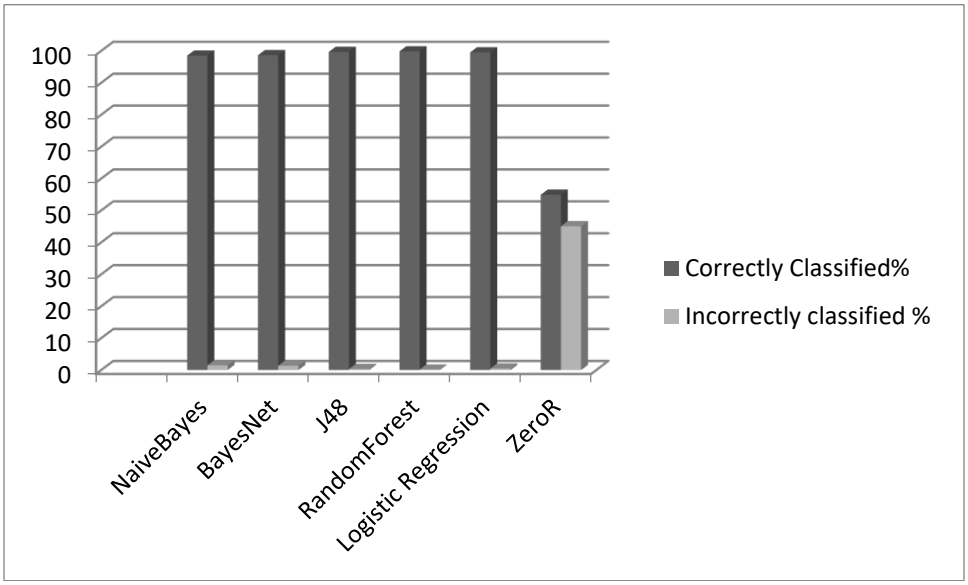
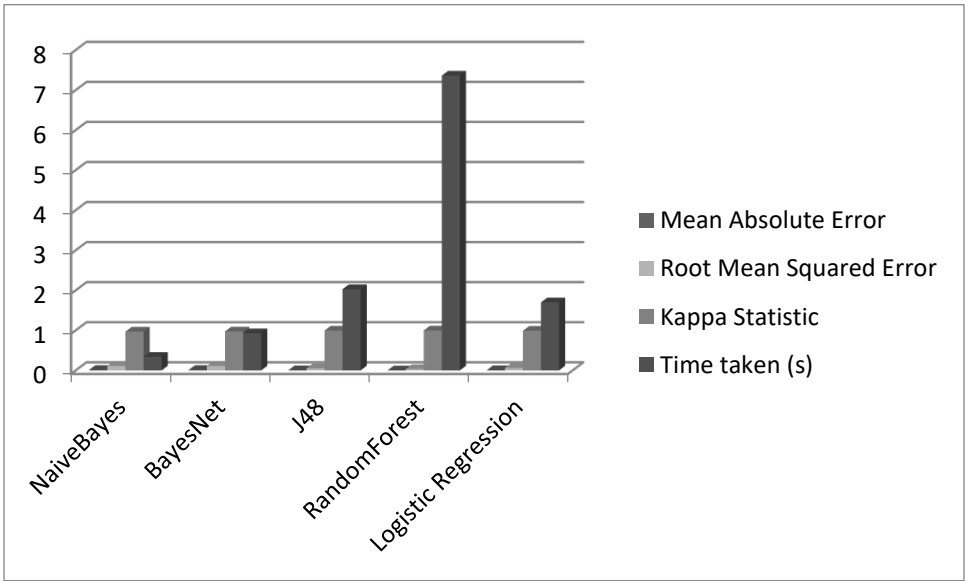


Figure 5: Accuracy visualization



DISCUSSION

Based on the evaluation results from Table 1 and Table 2, the RandomForest algorithm has the highest correctly classified instances of 19,955, which is 99.8449%. The least accurate classifier has several correctly classified cases of 19,690 (98.519%), the naive Bayes algorithm. Other algorithms have an accuracy of more than 98.65%, with the BayesNet correctly classifying 19,718 instances, J48 correctly classified 19,924 instances, and Logistic Regression correctly classified 19,892 instances. Our experimental base algorithm ZeroR correctly classified 10,980 instances, with 54.93% accuracy. The RandomForest takes a longer time of 7.36 seconds to finish the classification, while the Xero takes the shortest time to complete the computation.

The Kappa value defines the relationship between the reliability and the accuracy of the data (Vierra & Garrett, 2005). The Kappa is a metric that shows whether data is reliable and accurate. The results of reliability versus accuracy and comparison to the Kappa criteria define the relationship. For instance, data with a zero Kappa value has both reliability and accuracy. From our results, Xero has a zero Kappa value. The other algorithms have a Kappa value of more than 0.9, which shows that the reliability and accuracy relationship is almost perfect (Vierra & Garrett, 2005).

The error evaluation shows that the NaiveBayes algorithm has the highest mean absolute error compared to other algorithms. The algorithm has a mean absolute error of 0.0147, while the RandomForest has the lowest mean absolute error of 0.0032. This experiment's error analysis involves using the relative absolute error, the root mean squared error, and the root relative squared error.

From the True Positive and False Positive evaluation, the BayesNet has the highest True Positive rate of 1.0. The results show that the algorithm based on the True Positive rate accurately identified the malicious files which indeed had malware. Its false positive rate is 0.024, which is when PDF files were classified as malicious yet had no malware. The algorithm with the highest accuracy and lowest mean absolute error was selected as the best classifier for detecting malicious PDF files.

CONCLUSION

The five techniques used in this experiment were able to detect malicious PDF files and clean files. According to the results, the RandomForest, a tree-based algorithm, had an accuracy of 99.8449%. The algorithm was more accurate than NaiveBayes, BayesNet, Xero, and Logistic Regression because it minimizes the overall error rate, works well with massive data sets, and is highly sensitive. Random Forest, NaiveBayes, and BayesNet had a Kappa value of 0.9, making them excellent classifiers for this experiment. NaiveBayes algorithm had the highest mean absolute error because of the complexity of the data and the simplicity of its hypothesis. It was possible to propose using a RandomForest algorithm to complement other cybersecurity techniques, such as antivirus, to mitigate malware in PDF files.

In practice, this study will enhance future works in cybersecurity to understand and resolve vulnerabilities on PDF files. The results will be a reference for other studies that seek to study the potential of machine learning in detecting malicious PDF files.

REFERENCES

Adobe Fast Facts. (2020). Retrieved 28 September 2020, from https://www.adobe.com/about-adobe/fast-facts.html

Beaugnon, A., & Chifflier, P. (2018). Machine Learning for Computer Security Detection Systems: Practical Feedback and Solutions.

Bhuiyan, T., Begum, A., Rahman, S., & Hadid, I. (2018). API vulnerabilities: current status and dependencies. *International Journal of Engineering & Technology*, *7*(2.3), 9-13.

bin Othman, M. F., & Yau, T. M. S. (2007). Comparison of different classification techniques using WEKA for breast cancer. In *3rd Kuala Lumpur International Conference on Biomedical Engineering 2006* (pp. 520-523). Springer, Berlin, Heidelberg.

Cheng, H., Yong, F., Liang, L., & Wang, L. R. (2012, December). A static detection model of malicious PDF documents based on naive Bayesian classifier technology. In *2012 International Conference on Wavelet Active Media Technology and Information Processing (ICWAMTIP)* (pp. 29-32). IEEE.

Cuan, B., Damien, A., Delaplace, C., & Valois, M. (2018, July). Malware Detection in PDF Files Using Machine Learning.

CVE -Common Vulnerabilities and Exposures (CVE). Cve.mitre.org. (2020). Retrieved 7 October 2020, from https://cve.mitre.org/.

Huljanah, M., Rustam, Z., Utama, S., & Siswantining, T. (2019, June). Feature selection using random forest classifier for predicting prostate cancer. In *IOP Conference Series: Materials Science and Engineering* (Vol. 546, No. 5, p. 052031). IOP Publishing.

Kaur, E. D. P., & Singh, E. P. (2019). A Comparative Research of Rule-based Classification on Dataset using WEKA TOOL.

Khairunnahar, L., Hasib, M. A., Rezanur, R. H. B., Islam, M. R., & Hosain, M. K. (2019). Classification of malignant and benign tissue with logistic regression. *Informatics in Medicine Unlocked*, *16*, 100189.

Kuo, C. C., Hsu, K. C., & Yang, C. S. (2015). A novel way to generate the rule patterns for detecting malicious PDF documents. *Proceedings of the Asia-Pacific Advanced Network*, *40*, 43-49.

Nissim, N., Cohen, A., Moskovitch, R. *et al.* Keeping pace with the creation of new malicious PDF files using an active-learning based detection framework. *Secure Inform 5*(1), (2016). https://doi.org/10.1186/s13388-016-0026-3

NVD - Statistics. (2020). Retrieved 28 September 2020, from https://nvd.nist.gov/vuln/search/statistics?form_type=Basic&results_type=statistics&query=adobe+acrobat&search_type=last3years

Özdemir, A., Yavuz, U., & Dael, F. A. (2019). Performance evaluation of different classification techniques using different datasets. *International Journal of Electrical and Computer Engineering*, *9*(5), 3584.

Pandey, A. K., Tripathi, A. K., Kapil, G., Singh, V., Khan, M. W., Agrawal, A., ... & Khan, R. A. (2020). Trends in Malware Attacks: Identification and Mitigation Strategies. In *Critical Concepts, Standards, and Techniques in Cyber Forensics* (pp. 47-60). IGI Global.

Rajeshwaran, K. (2019). kartik2309/Malicious_pdf_detection. Retrieved 11 May 2020, from https://github.com/kartik2309/Malicious_pdf_detection

Smutz, C., & Stavrou, A. (2012, December). Malicious PDF detection using metadata and structural features. In *Proceedings of the 28th annual computer security applications conference* (pp. 239-248).

Ting, S. L., Ip, W. H., & Tsang, A. H. (2011). Is Naive Bayes a good classifier for document classification. *International Journal of Software Engineering and Its Applications*, *5*(3), 37-46.

Torres, J., & Santos, S. D. L. (2018). Malicious PDF Documents Detection using Machine Learning Techniques. In *Proceedings of the 4th International Conference on Information Systems Security and Privacy (ICISSP 2018)* (pp. 337-344).

Van der Heide, E. M. M., Veerkamp, R. F., van Pelt, M. L., Kamphuis, C., Athanasiadis, I., & Ducro, B. J. (2019). Comparing regression, naive Bayes, and random forest methods in the prediction of individual survival to second lactation in Holstein cattle. *Journal of dairy science*, *102*(10), 9409-9421.

Vierra, A., & Garrett, J. (2005). *Understanding Interobserver Agreement: The Kappa Statistic* [PDF]. Retrieved from http://web2.cs.columbia.edu/~julia/courses/CS6998/Interrater_agreement.Kappa_statistic.pdf

What is a PDF? Portable Document Format | Adobe Acrobat DC. (2020). Retrieved 27 September 2020, from https://acrobat.adobe.com/us/en/acrobat/about-adobe-pdf.html#:~:text=In%201991%2C%20Adobe%20co%2Dfounder,print%20them%20on%20any%20machine.

Zhang, J. (2018). MLPdf: an effective machine learning-based approach for PDF malware detection. *arXiv preprint arXiv:1808.06991*.

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WORK IN PROGRESS – INVESTIGATING THE ROLE OF ALIGNMENT AS A FOUNDATIONAL BUILDING BLOCK FOR WILLINGNESS TO ADOPT LEARNING ANALYTICS BY HIGHER EDUCATION FACULTY

Michael Knupp, Dakota State University

ABSTRACT

Higher education institutions (HEI) are beginning to invest heavily in learning analytics as a compliment to their existing suite of technologies used to enhance the pedagogical practices of instructors. A culture of learning analytics within HEI is emerging but there is not consensus on the value and effectiveness of the tools and practices that make up the culture. The emerging culture is exerting change forces on key stakeholders (namely the faculty member themselves) and these forces are not clearly understood. A lack of understanding of the change forces may result in unintended consequences for both the faculty member and the institution at large. Learning analytics is in its infancy and the adoption and integration by higher education faculty represents a new and emerging phenomenon that is worthy of study and understanding. With promises of reduced student dropout rates, improved student outcomes, better course pedagogy and backed by pressures of assessment and accountability, learning analytics is being trumpeted as the next best solution to our educational woes. However, despite these promises and despite the general belief that learning analytics may have true value, instructors have been slow, if not resistant, in learning analytics adoption. And while research on learning analytics design abounds, usage and adoption literature that focuses on the faculty member's perspective is scant. More research is needed to understand factors that either threaten or enable a higher education faculty member's willingness to adopt learning analytics. The following research proposal seeks to examine the influence of professional identity alignment, pedagogical alignment, learning analytics alignment and organizational alignment on a higher education faculty member's willingness to adopt learning analytics.

INTRODUCTION & BRIEF LITERATURE REVIEW

A data revolution is upon us. For-profit businesses have successfully capitalized on using vast amounts of data and sophisticated analytical tools to drive huge profits and tremendous market share (Thirathon, Wieder, Matolcsy, & Ossimitz, 2017; Davenport, 2006; LaValle, Lesser, Shockley, Hopkins, & Kruschwitz, 2011; Choo, et al., 2006). It is clear that organizations, as they always have, seek to make good strategic and operational decisions. However, the processes and tools available to make these decisions is rapidly changing. Organizations are beginning to adopt a culture of analytics (Gupta & George, 2016) and it becomes an interesting challenge to understand where higher education institutions (HEI) stand in this landscape.

HEIs are interesting organizations to study due to the relatively new exploration of analytics and the wide diversity of the analytics being used (Avella, Kebritchi, Nunn, & Kanai, 2016). Approximately ten years ago a call to arms was put forth to HEIs to migrate beyond traditional uses of analytics in management of enrollment, retention and alumni relations and explore the integration of analytics in the pure academic and learning space (Campbell, Deblois, & Oblinger, 2007). Early exploration of this space pushed HEIs to invest in analytics that provided true measurement of institutional goals (Norris, Baer, Leonard, Pugliese, & Lefrere, 2008). HEIs don't only use analytics to improve revenue or profit margins (traditionally viewed as business analytics), they also use analytics within the curriculum landscape (Norris, Baer, Leonard, Pugliese, & Lefrere, 2008). It is within the curriculum landscape where things get interesting as the broad field of analytics narrows to learning analytics (LA). In the ensuing years, the field of Learning Analytics begins to take shape. The first annual international conference in learning analytics and knowledge was held in 2010. The first edition of the Journal of Learning Analytics was published in 2013. In the inaugural issue, Seimens (2014) points out that higher education is comparatively late to the analytics game but their presence is important as data continues to play a key role in how learning transpires and how faculty make decisions within the learning context. While a multitude of different definitions of learning analytics have evolved over the years, the definition provided at the inaugural international conference on Learning Analytics in 2011 provides a sound base (Siemens, Long, Gasevic, & Conole, 2010): *"The measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and environments in which it occurs."* (p. 1). The use of the word 'optimizing' is noteworthy. Learning analytics imparts an economic lens on the educational process. It is possible that this economic lens may run orthogonal to an instructor's traditional view of education and to their own professional identity. Such a belief may influence a higher education faculty member's willingness to adopt learning analytics into their pedagogical practices. Learning analytics research conducted to date has primarily focused on LA design (Bakharia, et al., 2016; Greller & Drachsler, 2012), data visualization design (Echeverria, et al., 2018), or use cases

that support using LA as a retention or early warning system (Gasevic, Dawson, & Siemens, 2015). Literature reviews in learning analytics also show emerging concerns over data ownership, privacy, and ethics (Viberg, Hatakka, Balter, & Mavroudi, 2018; Avella, Kebritchi, Nunn, & Kanai, 2016). While there exists a generally shared belief in the positive impact and potential of learning analytics, institutions and individual faculty show surprisingly slow (perhaps even resistant) adoption rates (Herodotou, et al., 2017). Determining factors that influence this resilience poses an interesting research challenge. An important perspective is that LA represents a disruptive influence on the current culture in higher education institutions (Avella, Kebritchi, Nunn, & Kanai, 2016). Learning analytics push the barriers of accountability and assessment (Sergis & Sampson, 2017). While prior LA research projects point to the importance of the stakeholders and specifically the individual faculty member (Campbell, Deblois, & Oblinger, 2007), a research gap exists as it pertains to the perspective of the individual faculty member. Campbell, et al., (2007) specifically point to the importance of faculty in the process of utilizing learning analytics, *"Faculty are key to "interventions" ... For some faculty, analytics may provide a valuable insight into which students are struggling or which instructional approaches are making the greatest impact."* (p. 54). The faculty perspective gap opens an opportunity for further study. Specifically, it becomes interesting to explore the various personal and organizational constructs that affect the willingness of a higher education faculty member to adopt learning analytics. The existing body of learning analytics research does not sufficiently represent the perspective of the higher faculty member. This perspective is critical in understanding how various constructs may threaten or enable willingness to adopt learning analytics.

Statement of the Problem

An emergent phenomenon exists within higher education institutions. HEIs are slowly adopting a culture of learning analytics but there is not consensus on the value and effectiveness of the tools and practices that make up the culture. There exists tremendous variability in how individual faculty members interface with learning analytics as it relates to adoption, sense making, and influence on professional identity (Avella, Kebritchi, Nunn, & Kanai, 2016). A demand for more research to understand the beliefs of users of the learning analytics systems exists (Ferguson, et al., 2016). Ferguson, et al. (2016) specifically offer five different important questions that provide an appropriate starting point for the proposed research (p. 34):

> Q1: How do people behave when learning analytics initiatives are undertaken?
> Q2: What is the current state of awareness, acceptance, and beliefs about applying analytics to teaching and learning?
> Q3: How are analytics perceived in terms of usefulness and relevance?
> Q4: How significant are differences in regional or sector culture, values, and professional practice, in relation to implementing learning analytics?
> Q5: Which norms of professional practice, power, and influence do learning analytics challenge?

These questions are a foundational starting point and can be viewed through the lens of willingness to adopt. An important research agenda is to better understand key constructs that either serve to threaten or enable an individual higher education faculty member to be willing to adopt learning analytics into their daily practice. LA, like any analytics, should make the professional environment better, not worse. A culture of LA may have negative, unintended consequences on key stakeholders. A failure to recognize these consequences could contribute to continued poor LA adoption that in turn could limit the future evolution of educational systems. The LA research corpus lacks research placing the higher education faculty stakeholder front and center. Certainly, faculty buy-in plays a large role in LA adoption (Dawson, et al., 2018). The implications of the research can potentially aid practitioners by uncovering key constructs of how a learning analytics culture influences their willingness to adopt. This guides the following fundamental research questions.

> RQ1: What are the emergent enablers to a higher education faculty member's willingness to adopt learning analytics into their professional practice?
> RQ2: What are the emergent threats to a higher education faculty member's willingness to adopt learning analytics into their professional practice?
> RQ3: What role does the concept of alignment fill in determining a higher education faculty member's willingness to adopt learning analytics?

The research questions indicate theory testing research with a substantive focus on the alignment of learning analytics as examined through the lens of the higher education faculty member's perceptions of the intersection of the emergent

culture of learning analytics and their willingness to adopt. Research helps to understand the forces that a culture of learning analytics exerts on the higher education faculty member's willingness to adopt. These forces can be examined through the concept of alignment and specifically how the perceptions of learning analytics aligns to the faculty member's professional identity, their pedagogical practices, their efficacy with learning analytics and the organizational culture of which they work.

Theoretical Foundation

On the surface, the emergent culture of learning analytics in higher education represents significant change to extent educational culture. However, technology integration pushes the education domain to be in a constant state of change. The true underlying issues with learning analytics in higher education is adoption and integration. Similar research that focuses on the phenomenon of learning management system integration within secondary schools (Towne, 2018), reveals several theories applicable to this research. The phenomenon of learning analytics usage by higher education faculty in part represents an example of technology adoption. As such, theories such as the technology adoption model (TAM) (Davis F. , 1989) or the unified theory of acceptance and use of technology (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003) provide a good base. While TAM and UTAUT are widely used theories, they continue to prove helpful in understanding why certain technologies are adopted and why certain technologies are not. UTAUT represents a potential valuable theory as this theory specifically addresses concepts of performance expectancy, effort expectancy, and social influence. But UTUAT lacks specificity to the education domain and the perspective of the higher education faculty member. Cognitive science theories on decision-making such as Rational Choice Theory (Tversky & Kahneman, 1981) were also considered but fell short against the strength of the Technological Pedagogical Content Knowledge Framework (TPACK) (Mishra & Koehler, 2006). Higher education faculty are expected to incorporate new tools and new processes into their day-to-day workflow. Their ability to leverage learning analytics tools and information effectively may hinge in large part on both their self-identified analytical skillsets and their personal beliefs in learning new ways to evaluate student learning. TPACK provides a strong theoretical foundation for examining learning analytics adoption. The TPACK framework is visually depicted in Figure 1 (Koehler, Mishra, & Cain, 2013). The framework establishes seven core knowledge constructs that work in concert with each other to help explain technology integration in education; Technology Knowledge (TK), Content Knowledge (CK), Pedagogy Knowledge (PK), Technology-Content Knowledge (TCK), Technology Pedagogy Knowledge (TPK), Content-Pedagogy Knowledge (CPK) and Technology-Content-Pedagogy Knowledge (TCPK).

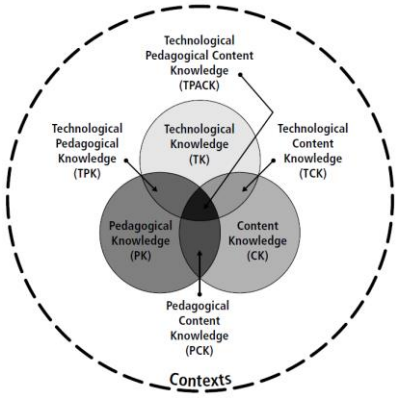

Figure 2 Technological Pedagogical Content Knowledge Framework

While technology is a broad based concept, within the confines of this research project, technology is specifically focused on learning analytics.

Proposed Hypotheses and Conceptual Model

The proposed research focuses on the fundamental building block of alignment and its association to willingness to adopt. Four specific alignments will be investigated; Professional Identity, Pedagogical, Learning Analytics, and Organizational. Figure 2 depicts the conceptual model for the research.

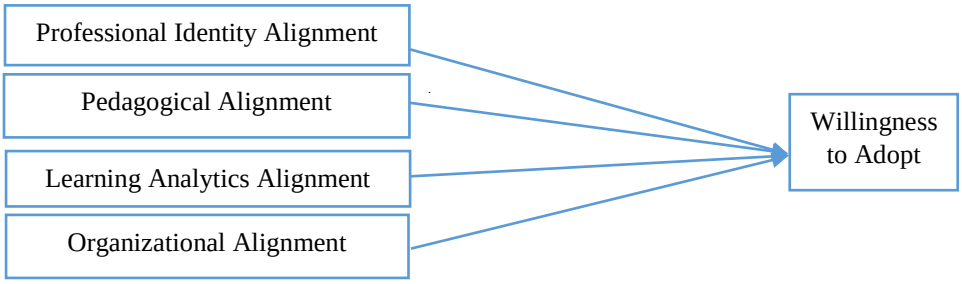

Figure 3 Conceptual Model for Willingness to Adopt Learning Analytics

Professional Identity Alignment

At the heart of the faculty member's work experience is their professional identity. Research points to professional identity key constructs as belonging, attachment, beliefs and institutional logics (Barbour & Lammers, 2015). The professional identities for some teachers shows variability over time and may be influenced by the institutional environment in which they work (Day, Kington, Stobart, & Sammons, 2006). The purpose of this research project is not intended to further examine the key constructs that make up one's professional identity. Nor is the focus to examine the stochastic stability of a higher education faculty member's professional identity. The purpose of this research is to examine how the strength of the alignment between the goals of learning analytics and the faculty member's professional identity impacts the faculty member's willingness to adopt learning analytics. Fundamental questions pertaining to perceptions of alignment to professional identity are not sufficiently addressed in the learning analytics literature. Professional identity is a key driver for how a higher education faculty member carries out their professional tasks and interacts with other actors in their professional system (Trede, Macklin, & Bridges, 2012). As such, it is important to understand how individual knowledge workers (higher education faculty) reconcile the emergent culture of analytics within higher education institutions with their professional identity as educators.

The first annual international conference on Learning Analytics in 2011 presents an important definition for learning analytics (Siemens, Long, Gasevic, & Conole, 2010): *"The measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and environments in which it occurs."* (p. 1). Inherent in this definition is the notion of optimization. Optimizing learning translates to making the learning process as efficient as possible with the highest possible quality standards. This conceptualization of learning analytics utilizes economic values and principles. This viewpoint of learning analytics is further supported by Quintero & Selwyn (2018) where they specifically critique the digitization of higher education as being *"consumed along economically rational lines."* (p. 32). Radu (2017) also argues the goal of optimizing student learning when describing learning analytics as an act involving collecting and measuring learner data. These definitions are essential when considering the influence of professional identity alignment on willingness to adopt. Key constructs like optimization and economic rationality may, or may not, align with how an individual faculty member views their professional self. As such, there may, or may not, be an alignment between learning analytics and professional identity. This alignment may be a key influencer in willingness to adopt.

Professional identity alignment is characterized by the degree to which a higher education faculty perceive the goals and purpose of learning analytics to align with their perception of their own professional identity. The strength of this alignment is hypothesized to influence the higher education faculty member's willingness to adopt learning analytics. Specifically, the following hypothesis emerges.

> H1: A higher education faculty member will be more willing to adopt learning analytics if they perceive a strong alignment between the learning analytics and their professional identity.

For example, assume a faculty member believes that at the core of being a teacher is the relentless commitment to improving the student learning experience. Furthermore, assume the same faculty member views a goal of learning analytics to uncover and bring to light pedagogical issues that contribute to impaired student learning. Therefore, the learning analytics are seen as a tool that can be used to improve the learning experience. In this case, there is strong alignment between the disparate views on professional identity and learning analytics. This strong alignment is

hypothesized to be an enabler of willingness to adopt learning analytics. Conversely, a misalignment is hypothesized to be a threat to willingness to adopt.

Pedagogical Alignment

Several literature reviews extract more of the "who" and the "what" of learning analytics in the form of a current state (Dawson, Gasevic, Siemens, & Joksimovic, 2014; Viberg, Hatakka, Balter, & Mavroudi, 2018). The general findings of such reviews are that published works tend to be descriptive and case study focused. The reviews also show that research generally lacks strong theoretical backgrounds and as such tends to be more conceptual than empirical. Also highlighted in such reviews is that learning analytics seem to over deliver on promise of potential and under deliver on effectiveness. Ferguson & Clow (2017) add additional support to this phenomenon and specifically offer a solution through the Learning Analytics Community Exchange project named Evidence Hub. The Evidence Hub provides a common space for educators to document where and how the use of learning analytics has had demonstrable positive impact. As LA continues to mature, implementation occurs in very specific situations; such as computer programming courses. Ihantola et al. (2015) review seventy-six different articles and conclude that most studies take place in individual courses, are point in time and not longitudinal and few are grounded in theory. An interesting outcome of the review is an RAP taxonomy for the papers reviewed. RAP deals with the extent to which the original research can be re-analyzed (R), extend the original analysis using different methods or tools (A), and repeatability of the original analysis process with new data (P). The net conclusion is that most learning analytics studies in computer programming are extremely difficult to replicate.

The conceptual framework offered in Figure 3 emphasizes the teacher as the core component and stakeholder to learning analytics design (Bakharia, et al., 2016). This model incorporates pedagogical intent. The teacher must process the various types of analytics within a given context in order to determine an appropriate course of action. This framework highlights the dual context of learning and teaching as these are two distinct processes.

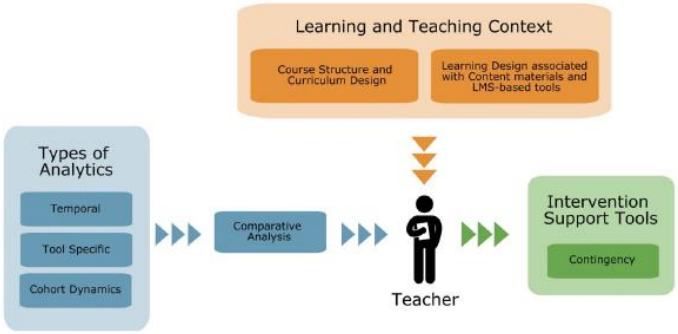

Figure 4. The Learning Analytics for Learning Design Conceptual Framework

Using this model, it is clear that learning analytics design and pedagogy are highly intertwined. As such, it is critical to examine the role that pedagogical alignment plays in a faculty member's willingness to adopt learning analytics. Pedagogical alignment describes the degree to which the higher education faculty member perceives the goals and purpose of learning analytics run congruent to specific pedagogical practices performed in a given instructional setting. The strength of this congruency is hypothesized to influence a higher education faculty member's willingness to adopt learning analytics and is specifically stated in the following hypothesis.

> H2: A higher education faculty member will be more willing to adopt learning analytics if they perceive a strong alignment between the learning analytics and various pedagogical practices.

For example, assume a higher education faculty incorporates the value of collaboration as a pedagogical practice. If the learning analytics fail to measure the strength and nature of teamwork within different course projects, there is a weak alignment between the learning analytics and the pedagogical practice. The weakness of this alignment is hypothesized to be a threat to willingness to adopt learning analytics. However, if the learning analytics clearly describe the nature and strength of an online discussion forum where students collaborate on a given assignment, there exists a strong alignment. Such an alignment may enable willingness to adopt learning analytics.

Learning Analytics Alignment

While learning analytics is still perceived to be in its infancy, the underpinnings date back to the early 1900s (Joksimovic, Kovanovic, & Dawson, 2019). These underpinnings include work in cognitive science, psychometric exploration, and the learning sciences. However, learning analytics as a true discipline starts to take shape in 2010s with the founding of the Educational Data Mining Society, the founding of the Society for Learning Analytics and Research, the establishment of the Learning Analytics and Knowledge Conference and the first publication of the Journal for Learning Analytics (Joksimovic, Kovanovic, & Dawson, 2019). Learning analytics are often characterized as a multidimensional discipline that highly leverage other fields such as research methods, learning sciences, data mining, information science, data visualization and psychology (Gasevic, Dawson, & Siemens, 2015). Learning analytics differentiates from other closely related fields of educational data mining, academic analytics and teaching analytics. Educational data mining is a rather broad term, and as a process, carries the high-level goal of making discoveries from the data collected in educational settings (Avella, Kebritchi, Nunn, & Kanai, 2016). The domain of learning analytics differs from academic analytics by focusing on the core-learning context instead of at the institutional level (Jorno & Gynther, 2018). Academic analytics at the institutional level primarily focus on areas such as enrollment management, retention management and donor management (Campbell, Deblois, & Oblinger, 2007; Greer, Thompson, Banow, & Frost, 2016). Teaching analytics aid faculty in effective course design and delivery (Siemens, 2014). Learning analytics are deeply entrenched in the learning space that occurs in courses delivered by faculty to students. In the early years, the main objective of learning analytics systems was an early alert system to identify students at risk. Research ensued on the effectiveness of such systems (Greer, Thompson, Banow, & Frost, 2016). Also seen in the early years is an important research project that focuses on stakeholders of learning analytics systems (Draschler & Greller, 2012). It comes as no surprise that students and faculty are the main stakeholders in the LA systems as they have the most to gain from usage of the system. An important result of this study shows that students do not believe they have the necessary competences to independently learn from the information provided by learning analytics. However, the same question was not proposed to the faculty participants in the study.

Barneveld & Campbell (2012) argue that learning analytics is a process that utilizes analytic techniques to support attainment of learning goals. Others argue that learning analytics is about tailoring the educational setting to specific needs and abilities of the individual learner (Avella, Kebritchi, Nunn, & Kanai, 2016). The literature supports the difficulty in applying an exact definition to learning analytics. However, the central tenant running through all working definitions is learning analytics encompass data, tools, methods, stakeholders, systems and policies all focused in the context of a learning environment working to understand and best facilitate the process of learning. As researchers have grappled with understanding learning analytics and their implementations and usage, several key research streams emerge.

There exists a myriad of different research streams within the field of learning analytics. As the corpus of research articles in LA has become larger, literature reviews garner more attention. Sergis & Sampson (2017) focus their literature review on the intersection of learning analytics and teaching analytics. They differentiate the two by arguing that teaching analytics focus on course design and learning analytics focus on learners and the learning context. They further advocate a consolidation of the two for analytics in the educational space to reach its true potential. Multiple literature reviews concentrate on the methods, challenges and benefits of learning analytics (Avella, Kebritchi, Nunn, & Kanai, 2016; Leitner, Khali, & Ebner, 2017). Avella highlights that learning analytics utilize methods such as visual data analysis, social network analysis, prediction, clustering and relationship mining. The bricolage nature of learning analytics shows itself with these methodologies as the methods are adopted from traditional educational data mining techniques. Avella's literature search also reveals numerous perceived benefits of the usage of learning analytics: improved student learning outcomes, personalized learning and improved instructor performance. Balancing against these perceived benefits are challenges of how to truly optimize the learning environment, appropriately analyze the analytics and issues with ethical use and data privacy. Other work points to available time to work with learning analytics and lack of consistent culture as challenges (Leitner, Khali, & Ebner, 2017). Overall, the literature reviews in learning analytics show that the field is strong and an area of interest for many researchers and practitioners. The reviews highlight issues with grounding LA in theory and unrealized potential. The reviews also highlight the complexity of the emerging domain. Higher education faculty that do not possess confidence in understanding the underpinnings of this emergent domain may be less willing to adopt learning analytics. Perhaps in an effort to ground LA more in theory, researchers offer many conceptual frameworks for LA system design and culture. These conceptual frameworks are the focus of the second key LA research stream.

Greller & Draschler (2012) conceptualize a learning analytics framework around key dimensions: stakeholders, internal limitations, external constraints, instruments, objectives and data. Figure 4 depicts their framework. The framework emphasizes the complexity of learning analytics and brings to light specific limitations and constraints. The research acknowledges the competencies of key stakeholders, as well as their willingness to accept the technology, influence usage and adoption. Furthermore, standard norms and conventions serve as external limitations of learning analytics.

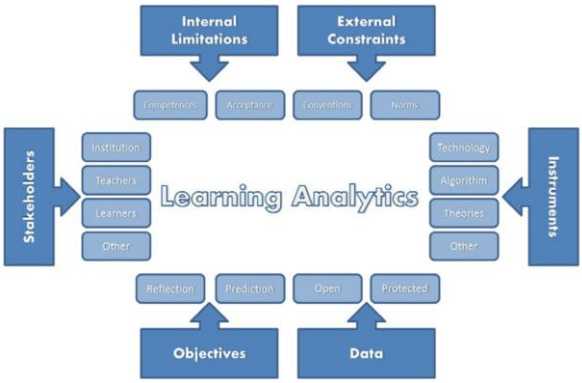

Figure 5. Critical dimensions of learning analytics

Clow (2012) envisions the conceptual framework of learning analytics as a cycle depicted in Figure 5. Learners are at the top of this cycle and while a cycle does not technically have a true starting position, the framework assumes learners initiate the learning analytics cycle. Learners create data that is collected, measured and analyzed through metrics. The metrics lead to interventions with learners. In turn, learners create new data and the cycle continues. The central concept of this model is the existence of an inherent cycle in LA; a built-in feedback loop within the teaching-learning process.

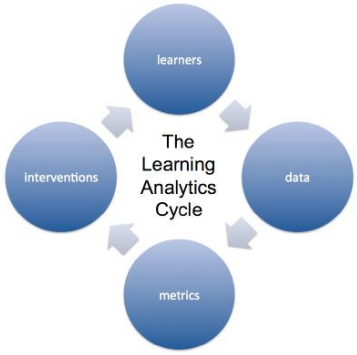

Figure 6. The Learning Analytics Cycle

Echeverria, et al. (2018) stress the importance of data storytelling in learning analytics through their conceptual model depicted in Figure 6. The model comes in response to an investigation on how faculty interpret data visualizations. The research shows that faculty have difficulty with sense making of learning analytics. Faculty are able to construct basic stories based on the visualizations, but were unable to effectively determine if the story was accurate. Moreover, because faculty are unable to develop effective interpretations of the learning analytics visualizations, little to no true insight can be garnered. The researchers argue analytic visualizations are more effective for faculty if the visualizations include data storytelling elements that help guide the end user in a particular direction. In essence, the story being told by the visualization should be self-evident to the faculty. Proper sense making can then lead to appropriate intervention strategies.

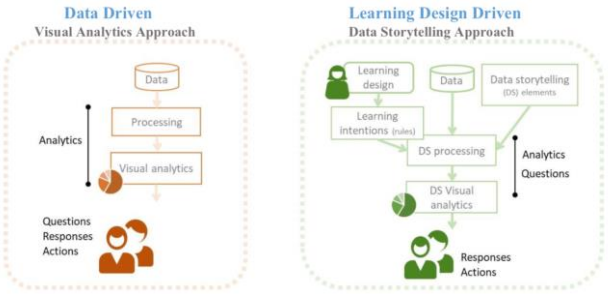

Figure 7. Data Driven Model vs Data Storytelling Model of Learning Analytics Design

The various definitions and conceptual frameworks illustrate that learning analytics is a complex and evolving domain. Furthermore, higher education institutions that adopt a culture of analytics may find challenges with implementing a consistent set of integration objectives and policies. Given that faculty are at the heart of LA implementation and usage, research that seeks to understand the impact of learning analytics efficacy on willingness to adopt is of value. A particular aspect of learning analytics systems is the exact design of the system; namely what data to display and how to display it. LA design represents a third key research stream.

Learning analytics are typically presented to the end user in the form of a visual display. Often times the display takes the form of a dashboard. Basic elements of dashboards typically include colorful graphs, charts and standard quantitative data. There continues to be considerable work to understand the most effective visual display techniques (Echeverria, et al., 2018; Alhadad, 2018; Okan, Galesic, & Garcia-Retamero, 2016; Jorno & Gynther, 2018). Sense making of data is a challenge and Echeverria et al. (2018) address this directly by advocating that LA visualizations need to include storytelling elements in order to properly guide the stakeholder in the sense making process. An absence of such elements can lead to improper interpretations that subsequently lead to ineffective intervention strategies. Visualizations are a communication tool and proper consideration needs to be given to design (Alhadad, 2018). Specifically, Alhadad emphasizes seven guidelines for effective design that combine elements of visual attentiveness as well as cognition. Visual attentiveness is influenced by specific features of the element such as form, color and size. This is referred to as salience. A stakeholder's attentiveness and cognitive understanding can be influenced by their prior experience with similar visualizations. Chunking and visual clutter also contribute to effective design. The specific design elements of the LA visualizations are only part of the picture. It is the end user, the stakeholder, the data client, the student and the teacher that must interpret and act on the visualization. Okan, Galesic, & Garica-Retamero (2016) empirically test the influence of graph literacy on how individuals view health related graphs. The researchers measure eye tracking between a group of high graph literacy participants and a group of low graph literacy participants. Their findings show that participants with low graph literacy rely more on spatial-conceptual relationships such as tall bars mean more, spend more time on textual features of graphs and ultimately have difficulty properly interpreting conflicts between the features of the visual elements and its true meaning. Conversely, participants with high graph literacy spend more time viewing the graph and elements that are specific and relevant to the cognitive task at hand. Perceived relevance of the LA display is critical. The perceived relevance is a part of the sense making process. It is through the sense making process that individuals reach a point of understanding and action. Good LA design will naturally lead to actionable insight (Jorno & Gynther, 2018). Actionable insights are garnered through review of the data and then subsequently acted upon. Jorno & Gynther (2018) suggest that LA design which focuses on actionable insight must give consideration to content, purpose, interpretation and outcome. These elements are critical because they vary tremendously from one learning analytic to another.

Extrapolating from this research one can surmise that the needs of the faculty are not adequately being met through the current suite of learning analytics systems. This provides further credence for the importance of faculty voice and ensuring the current state of learning analytics by diverse faculty is clearly understood so that it can be leveraged in future design work and implementations. Diversity is an undercurrent of all the research in LA design. There is diversity in the design approach and diversity among the stakeholders. Researchers also vary on what types of data should ultimately be measured. Some argue that LA systems should be focused more on measuring "soft skills" which are the true needed skills for the future (Thompson, 2016). Others argue that LA algorithms that use traditional transactional data should not focus as much on prediction accuracy, but rather they should recognize the learning environment is much more diverse and as such LA algorithms should focus more on the transformative perspective (Kitto, Shum, & Gibson, 2018). Sense making will vary from individual to individual and designing for such diversity

can be very challenging. If the result of the sense making process is ultimately confusion, the higher education faculty member may be less willing to adopt learning analytics.

Looking forward, emerging themes in learning analytics research include ethical data use and reporting as well data privacy (Campbell, Deblois, & Oblinger, 2007; Greller & Drachsler, 2012; Avella, Kebritchi, Nunn, & Kanai, 2016; Viberg, Hatakka, Balter, & Mavroudi, 2018). Ethics and privacy will continue to be critical areas of exploration and worthy of future study. Other identified gaps in the LA research include evidence based learning analytics (Bollenback & Glassman, 2018; Gasevic, Dawson, & Siemens, 2015; Dawson, Gasevic, Siemens, & Joksimovic, 2014; Ferguson, et al., 2016; Mahroeian, Daniel, & Butson, 2017), LA research based in theory (Greller & Drachsler, 2012; Echeverria, et al., 2018) and increased stakeholder involvement (Ferguson, et al., 2016; Viberg, Hatakka, Balter, & Mavroudi, 2018; Herodotou, et al., 2017; Mahroeian, Daniel, & Butson, 2017).

The aforementioned literature highlights the complexity of issues in fully understanding what exactly are learning analytics and what are the required skills to effectively utilize learning analytics. The focus of this study is not to further clarify a definition of learning analytics. Nor is the purpose to provide a taxonomy of required skills needed to be effective users of learning analytics. A focal point of this research to determine how a faculty member's perceived efficacy with regards to how they understand learning analytics might influence their willingness to adopt. It is difficult to implement what we don't understand. Learnings analytics represents an emerging discipline and if higher education faculty do not have confidence in their understanding of learning analytics or their ability to develop skills in the usage of learning analytics, then it is unlikely they will be willing to incorporate learning analytics into their daily practice. Literacies in quantitative information, data in general and graph interpretation are all hypothesized to influence a higher education faculty member's willingness to adopt learning analytics. This basic tenant is captured in the following hypothesis.

> H3: A higher education faculty member will be more willing to adopt learning analytics if they perceive themselves to have high efficacy with regards to the core constructs of learning analytics; namely data, visual representation of data and data-informed decision making.

A perceived high efficacy is equivalent to a strong learning analytics alignment.

Organizational Alignment

There exists great pressure to make informed and impactful decisions based on data; both at the personal and business level. As businesses race to integrate data and data driven decision methodologies into their organizations, the need to understand the role of an analytics culture arises. Success of the institution may hinge on their ability to adopt a data driven model for critical strategic and operational initiatives. Organizational culture plays a large role in quality management and performance (Naor, Goldstein, Linderman, & Schroeder, 2008). Investigations into organizational culture within HEIs are at a subordinate level to standard commercial businesses. Organizations that culturally have an over reliance on decision support systems may indeed fail to meet their objectives (Aversa & Cabantous, 2018). It is important to understand the key factors that minimize failures when utilizing decision support systems (DSS) or data driven decision-making methodologies. A blind adoption of a DSS that is void of critical review may culminate in unintended and undesirable outcomes. Data and analytics should ultimately empower the knowledge worker and make them more effective in their role. A culture of analytics should clarify and not cloud. Moreover, learning analytics adoption on a large scale in higher education is sporadic at best (Dawson, et al., 2018). Researchers seem to concur that more work is needed to explore and mitigate barriers to LA adoption (Herodotou, et al., 2017; Viberg, Hatakka, Balter, & Mavroudi, 2018; Ferguson, et al., 2016; Gasevic, Dawson, & Siemens, 2015). Current research points to LA design, training, staff support and lack of time as key adoption challenges (King, 2017; Herodotou, et al., 2017); which are important, but all matters of logistics.

There is broad based consensus that learning analytics have a pervasive goal in aiding the decision making process of stakeholders that persistently takes place in various learning contexts (Bakharia, et al., 2016; Greller & Drachsler, 2012; Avella, Kebritchi, Nunn, & Kanai, 2016; Alhadad, 2018). The value proposition of learning analytics systems is clear (Avella, Kebritchi, Nunn, & Kanai, 2016) *"Going forward, schools must recognize the importance of implementing a data-driven approach to education. The use of performance systems allows for increased and more productive decision-making, the identification of trends and problematic areas, and the more efficient allocation of*

resources." (p. 25). History shows that more and more universities are embracing learnings analytics into their organizational culture. This emerging phenomenon is worthy of additional study.

An organizational culture that reflects a high value of the usage of data and analytical tools to enrich and deepen the educational experiences of faculty and students will likely be an enabler to an individual higher education faculty member's willingness to adopt learning analytics.

Organizational capacity refers to the how well the organization is equipped to implement a particular initiative. This positioning can be based on financial capacity, intellectual capacity, or technical capacity. It is important that an organization with a certain culture also has the true capacity to carry out that culture. Specifically, with learning analytics adoption, if the institution does not currently have the technical systems in place to capture insightful educational data and they do not carry the financial ability to acquire such systems, it is unlikely that an individual higher education faculty member will choose to adoption learning analytics; even on a small scale. The following relationship between organizational culture-capacity and learning analytics is hypothesized.

> H4: A higher education faculty member will be more willing to adopt learning analytics if they perceive a strong alignment between their organization's critical learning analytics readiness factors and the infrastructure requirements of learning analytics.

Statement of Purpose

The purpose of this quantitative theory testing study is to examine the roll of alignment, as well as, the threats and enablers that a learning analytics culture exert on the willingness of fulltime higher education faculty to adopt learning analytics into their professional practice. Of particular research interest is fulltime faculty that teach undergraduate courses at universities that offer traditional four-year bachelor's degrees. The emerging culture is exerting forces on key stakeholders (namely the faculty member themselves) and these forces are not clearly understood. A lack of understanding of the forces may result in unintended consequences for both the faculty member and the institution at large. The proposed research study seeks to fill a gap in the learning analytics research literature as it pertains to adoption and perceptions of learning analytics from higher education faculty. The proposed research also seeks to serve the practitioner community by offering insight into challenges and opportunities of learning analytics usage and adoption within higher education institutions.

PROPOSED RESEARCH METHODOLOGY

The proposed research is a quantitative study that will use surveys as the data collection methodology. The independent constructs of the study are Professional Identity Alignment, Pedagogical Alignment, Learning Analytics Alignment and Organizational Alignment. The dependent construct of the study is Willingness to Adopt. Only higher education faculty members with a minimum of five years in their current role will be allowed to complete the survey. The survey will be designed to collect basic demographic information of the respondent. As learning analytics is not ubiquitous among universities and within higher education faculty, the survey will present a formal definition of learning analytics that can be used when responding to the various survey items. A minimum of four items per construct will be used in the survey. A five-point Likert scale will be used for the construct items. A pilot study will likely be needed to validate the integrity of the survey. Below is a working discussion of components and structure of the survey.

Learning Analytics Definition

For the purposes of this study, learning analytics is defined as data, tools and analytical techniques that are collectively utilized within the educational environment in an effort to best facilitate the teaching and learning process. Examples of learning analytics may include, but are not limited to, dashboards, statistical charts, event logs, student performance visualizations and social network graphs.

Basic Demographics

1. How many years have you been a practicing higher education faculty member?
2. How many different universities have you worked for?
3. What is your major discipline that you teach within?

4. How frequently do you incorporate formal learning analytics into your daily practices?
    a. Do not incorporate learning analytics into my daily practices
    b. Extremely Infrequently (1 – 2 times per month)
    c. Fairly Infrequently (3 – 8 times per month)
    d. Moderately Frequently (9 – 16 times per month)
    e. Extremely Frequently (17+ times per month)
5. How would you characterize the sophistication of the learning analytics that you incorporate into your daily practices?
    a. Do not incorporate learning analytics into my daily practices
    b. Sophistication of learning analytics is very basic.
    c. Sophistication of learning analytics is more basic than complex.
    d. Sophistication of learning analytics is somewhat basic and somewhat complex.
    e. Sophistication of learning analytics is more complex than basic.
    f. Sophistication of learning analytics is very complex.

Each of the independent constructs of professional identity alignment, pedagogical alignment, learning analytics alignment and organizational alignment will be measured across a standard five-point Likert scale that focuses on the concept of agreement. Agreement is an indication of alignment strength. The planned scale will include the following five possible choices.

Strongly Disagree
Disagree
Undecided
Agree
Strongly Agree

Professional Identity Alignment

Professional identity alignment refers to the alignment between the perceived goals and purpose of learning analytics and the individual's beliefs about the nature of their professional identity. A strong alignment indicates the higher education faculty member believes the goals and purpose of learning analytics run parallel to their professional identity. A weak alignment indicates the perceptions about learning analytics are not congruent with the perceptions of their own professional identity. Professional identity alignment is specifically operationalized through the following statements.

PI1 – Learning analytics embody what it means to be a higher education faculty member.
PI2 – Learning analytics bring me closer to the professional community of higher education faculty members.
PI3 – Learning analytics hinder my ability to achieve my professional goals.
PI4 – Learning analytics embrace the ideals of being a higher education faculty member.
PI5 – Learning analytics reflect my vision of what it means to be a higher education faculty member.

Pedagogical Alignment

Pedagogical alignment refers to the alignment between the perceived goals and purpose of learning analytics and the varying pedagogical philosophies and needs. Pedagogical alignment dovetails strongly with the pedagogical focus within TPACK. Resarch has attemped to measure TPACK as it directly relates to required skills of the 21st century (Valtonen, Sointu, Kontkanen, Lambert, & Mäkitalo-Siegl, 2017). The items used to operationalize pedagogical alignment are adapted from Valtonen's research. A strong alignment indicates the higher education faculty member believes the goals and purpose of learning analytics run parallel to pedagogical practices. A weak alignment indicates the perceptions about learning analytics are not consistent with the perceptions of pedagogical practices. Pedagogical alignment is specifically operationalized through the following statements.

PD1 – Learning analytics provide a useful set of tools for developing reflective thinking within students.
PD2 – Learning analytics provide a useful set of tools for developing independent learners.
PD3 – Learning analytics provide a useful set of tools for promoting sharing of ideas and thinking together within students.

PD4 – Learning analytics provide a useful set of tools for developing creative thinking.
PD5 – Learning analytics provide a useful set of tools for enhancing student's ability to problem solve within groups.
PD6 – Learning analytics provide a useful set of tools for developing critical thinking.

Learning Analytics Alignment

Learning analytics alignment refers to the alignment between the perception of the required necessary skills and competencies for learning analytics adoption and the perception of current skills and competences with regards to learning analytics usage. Learning analytics is an emerging field that is heavily rooted in technology. As such, the higher education faculty member's self efficacy with regards to technology may play an important role in adoption behavior. Research that focuses on technical self efficacy proves valuable when operationalizing learning analytics alignment. Kent and Giles measured technical self efficacy in pre-service teachers and the instrument used within this research provides a base for operationlizing learning analytics alignment (Kent & Giles, 2017). A strong alignment indicates the higher education faculty member believes they possess high efficacy with regards to the prerequisite skill sets and competencies required to successfully integrate learning analytics into their professional practice. A weak alignment indicates the higher education faculty member believes their current skills and competencies with the core constructs of learning analytics are deficient. Learning analytics alignment is specifically operationalized through the following statements.

LA1 – I believe I am well prepared to evaluate various learning analytics to support teaching and learning
LA2 – I believe I can effectively select and use various learning analytics to support teaching and learning
LA3 – I believe I can effectively integrate learning analytics across teaching and learning within my respective discipline.
LA4 – I believe I can effectively determine why, when and how to use learning analytics in education.

Organizational Alignment

Organizational alignment refers to the alignment between the perception of the organization's current culture and the critical readiness factors for learning analytics adoption. A strong alignment indicates the higher education faculty member believes the current organizational culture well positions the organization to successfully adopt learning analytics. A weak alignment indicates the higher education faculty member believes their current organization lacks appropriate readiness factors to successfully incorporate learning analytics into the organization. The work to operationalize organizational alignment is still ongoing as of the time of this writing.

OA1 – TBD
OA2 – TBD
OA3 – TBD
OA4 – TBD
OA5 – TBD

Willingness to Adopt (Dependent Construct)
Willingness to adopt is the dependent construct in this study. The study seeks to determine if a positive alignment construct will positively influence a higher education faculty member's willingness to adopt learning analytics. It is possible that a faculty member is already using learning analytics. In this case, willingness to adopt will be understood as willingness to adopt learning analytics on a larger scale. Willingness to adopt is a form of likelihood, and as such, the five point Likert scale will embody the concept of likelihood.

WTA – How willing are you to adopt (or to adopt on a larger scale if currently using) learning analytics into your daily practice as a higher education faculty member?

Definitely Willing
Probably Willing
Possibly Willing
Probably Not Willing
Definitely Not Willing

PLANNED ANALYSIS TECHNIQUES AND EXPECTED RESULTS

The survey results will be analyzed using traditional statistical techniques. Hair provides a thorough account on widely accepted statistical practices for multivariate data analysis (Hair, Black, Babin, & Anderson, 2009).

It is expected that results will confirm that alignment plays a key role in a higher education faculty member's willingness to adopt learning analytics into their daily practices. It is unknown if the strength of each construct will be consistent or if variations will present themselves.

If the conceptual model is enhanced to include moderators or mediators, then proper statistical analysis will be needed to measure their affects.

DISCUSSION

A possible outcome of this research includes a clearer picture of how the emergent culture of learning analytics in HEIs is perceived by the faculty member and more specifically how faculty reconcile this culture against their views of their own professional identity, pedagogical beliefs and views of learning analytics within the organization. In tangent to this outcome, the proposed research may also highlight challenges and opportunities of aligning learning analytics culture to the professional identity of educators. Practitioners can benefit from such insights. A clearer picture of the true cultural state of analytics affects their ability to fulfill strategic and operational tasks. Additionally, knowledge in this area adds to the body of knowledge in organizational culture and how an individual best incorporates data and analytics into their professional lives. This research may yield significant insights into the role that an analytics culture plays in an organization's ability to achieve strategic and operational objectives and possibly uncover unintended consequences of said culture. This outcome centers on the assumption that a HEI is overtly working to achieve a more data-centric supported decision-making model. Knowledge such as this is valuable to both practitioners and the research community. The research extends the level of understanding of the role of organizational culture because a new culture of analytics is emerging. A comprehensive understanding of the impact of an analytics culture on the individual educator does not yet exist. Lastly, the research may uncover a deeper understanding of the success factors and barriers for adopting a culture of analytics. This is perhaps the most valuable insight. As HEIs race to adopt a culture of analytics, they struggle to understand the critical success factors to implement such organizational change. They are also insensitive to potential barriers. Lack of understanding in both areas contributes to an elongated and tumultuous change process. This change process must in part focus on the impact to the individual educator. The individual faculty member sits at the center of the learning analytics culture. This research agenda benefits an employee centric view of learning analytics usage.

REFERENCES

Alhadad, S. (2018). Visualizing data to support judgement, inference, and decision making in learning analytics: Insights from cognitive science and visualization. *Journal of Learning Analytics*, 60-85.

Avella, J., Kebritchi, M., Nunn, S., & Kanai, T. (2016). Learning analytics methods, benefits, and challenges in higher education: A systematic literature review. *Online Learning, 20*(2), 13-29.

Aversa, P., & Cabantous, L. (2018, September). When Decision Support Systems Fail: Insights for Strategic Information Systems from Formula 1. *The Journal of Strategic Information Systems, 27*(3), 221-236.

Bakharia, A., Corrin, L., de Barba, P., Kennedy, G., Gasevic, D., Mulder, R., & Lockyer, L. (2016). A conceptual framework linking learning design with learning analytics. *Proceeding of the Sixth International Conference on Learning Analytics & Knowledge* (pp. 329-338). Edinburgh: ACM.

Barbour, J., & Lammers, J. (2015). Measuring professional identity: a review of the literature and a multilevel confirmatory factor analysis of professional identity constructs. *Journal of Professions and Organization, 2*(1), 38-60.

Barneveld, A., & Campbell, J. (2012). Analytics in higher education: establishing a common language. *Educause*, 1-11.

Bollenback, D., & Glassman, A. (2018). Big data in higher education: Adjunct faculty perceptions of learning analytics and their uses. *Issues in Information Systems, 19*(3), 71-80.

Campbell, J., Deblois, P., & Oblinger, D. (2007). *Academic analytics a new tool for a new era.* EDUCAUSE.

Choo, C., Furness, C., Paquette, S., Berg, H., Detlor, B., Bergeron, P., & Heaton, L. (2006). Working with information: information management and culture in professional services organizations. *Journal of Information Science, 32*(6), 491-510.

Clow, D. (2012). The learning analytics cycle: closing the loop effectively. *Proceedings of LAK12: 2nd International Conference on Learning Analytics & Knowledge* (pp. 134-137). Vancover: ACM.

Davenport, T. (2006). Competing on analytics. *Harvard Business Review, 84*(1), 98.

Davis, F. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly, 13*(3), 319-339.

Dawson, S., Gasevic, D., Siemens, G., & Joksimovic, S. (2014). Current state and future trends: a citation network analysis of the learning analytics field. *Proceedings of the fourth international conference on learning analytics and knowledge* (pp. 231-240). Indianapolis: ACM.

Dawson, S., Poquet, O., Colvin, C., Rogers, T., Pardo, A., & Gasevic, D. (2018). Rethinking learning analytics adoption through complexity leadership theory. *Proceedings of the 8th International Conference on Learning Analytics* (pp. 236-244). Sydney: ACM.

Day, C., Kington, A., Stobart, G., & Sammons, P. (2006). The personal and professional selves of teachers: stable and unstable identities. *British Educational Research Journal, 34*(2), 601-616.

Draschler, H., & Greller, W. (2012). The pulse of learning analytics understandings and expectations from the stakeholders. *Proceedings of the 2nd international conference on learning analytics and knowledge* (pp. 120-129). ACM.

Echeverria, V., Martinez-Maldonado, R., Shum, S., Chiluiza, K., Granda, R., & Conati, C. (2018). Exploratory versus explanatory visual learning anayltics: Driving teachers' attention through educational data storytelling. *Journal of Learning Analytics, 5*(3), 72-97.

Ferguson, R., & Clow, D. (2017). Where is the evidence?: a call to action for learning analytics. *Proceedings of the seventh international learning analytics & knowledge conference* (pp. 56-65). Vancover: ACM.

Ferguson, R., Brasher, A., Clow, D., Cooper, A., Hillaire, G., Mittelmeier, J., . . . Vuorikari, R. (2016). *Research Evidence on the Use of Learning Analytics: Implications for Education Policy.* Seville: Joint Research Center.

Gasevic, D., Dawson, S., & Siemens, G. (2015). Let's not forget: Learninga analytics are about learning. *TechTrends, 59*(1), 64-71.

Greer, J., Thompson, C., Banow, R., & Frost, S. (2016). Data-driven programmatic change at universities: What works and how. *Proceedings of the Conference of Learning Analytics and Knowledge*, (pp. 32-35).

Greller, W., & Drachsler, H. (2012). Translating learning into numbers: A generic framework for learning analytics. *Educational Technology & Society, 15*(3), 42-57.

Gupta, M., & George, J. (2016). Toward the development of a big data analytics capability. *Information & Management, 53*(8), 1049-1064.

Hair, J., Black, W., Babin, B., & Anderson, R. (2009). *Multivariate Data Analysis* (7th ed.). Pearson.

Herodotou, C., Rienties, B., Boroowa, A., Zdrahal, Z., Hlosta, M., & Naydenova, G. (2017). Implementing predictive learning analytics on a large scale: the teacher's perspective. *Proceeding of the seventh international learning analytics & knowledge conference* (pp. 267-271). ACM.

Ihantola, P., Vihavainen, A., Ahadi, A., Butler, M., Borstler, J., Edwards, S., & Rubio, M. (2015). Educational data mining and learning analytics in programming: literature review and case studies. *Proceedings of the 2015 ITiCSE on Working Group Reports* (pp. 41-63). Vilnius: ACM.

Joksimovic, S., Kovanovic, V., & Dawson, S. (2019). The Journey of Learning Analytics. *HERDSA Review of Higher Education, 6*, 37-63.

Jorno, R., & Gynther, K. (2018). What constitutes an 'actionable insight' in learning analtyics? *Journal of Learning Analytics, 5*(3), 198-221.

Kent, A., & Giles, R. (2017). Presetive Teachers' Technology Self Efficacy. *SRATE Journal, 26*(1), 9-20.

King, J. (2017). *The nature and extent of instructor's use of learning analytics in higher education to inform teaching and learning.* Dissertation. Retrieved from https://digitalscholarship.unlv.edu/thesedissertations/2998

Kitto, K., Shum, S., & Gibson, A. (2018). Embracing imperfective in learning analytics. *Proceedings of the 8th International Conference on Learning Analytics and Knowledge* (pp. 451-460). Sydney: ACM.

Koehler, M., Mishra, P., & Cain, W. (2013). What is technological pedagogical content knowledge (TPACK)? *Journal of Education, 193*(3), 13-19.

LaValle, S., Lesser, E., Shockley, R., Hopkins, M., & Kruschwitz, N. (2011). Big Data, Analytics and the Path from Insights to Value. *MIT Sloan Managament Review, 52*(2), 20-31.

Leitner, P., Khali, M., & Ebner, M. (2017). *Learning analytics in higher education - a literature review.* Springer, Cham.

Mahroeian, H., Daniel, B., & Butson, R. (2017). The perceptions of the meaning and value of analytics in New Zealand higher education institutions. *International Journal of Educational Technology in Higher Education,* 1-17.

Mishra, P., & Koehler, M. (2006). Technological pedagogical content knowledge; A framework for teacher knowledge. *Teachers college record, 108*(6), 1017-1054.

Naor, M., Goldstein, S. M., Linderman, K. W., & Schroeder, R. G. (2008, November). The Role of Culture as Driver of Quality Management and Performance: Infrastructure Versus Core Quality Practices. *Decision Sciences, 39*(4), 671-702.

Norris, D., Baer, L., Leonard, J., Pugliese, L., & Lefrere, P. (2008). *Action Analytics: Measuring and Improving Performance That Matters in Higher Education.* EDUCAUSE.

Okan, Y., Galesic, M., & Garcia-Retamero, R. (2016). How people with low and high graph literacy process health graphs: evidence from eye-tracking. *Journal of Behavioral Decision Making, 29*((2-3)), 271-294.

Quintero, L. J., & Selwyn, N. (2018). More than tools? Making sense of the ongoing digitizations of higher education. *International Journal of Educational Technology in Higher Education, 15*, 26-35.

Radu, I. (2017). Emergent technologies for learning analytics. *The 13th International Scientific Conference eLearning and Software for Education. 2*, pp. 509-514. Bucharest: "Carol I" National Defence University.

Sergis, S., & Sampson, D. (2017). Teaching and learning analytics to support teaching inquiry: A systematic literature review. *Learning Analytics: Fundamentals, applications, and trends*, 25-63.

Siemens, G. (2014). *Supporting and promoting learning analytics* (Vol. 1). Journal of Learning Analytics.

Siemens, G., Long, P., Gasevic, D., & Conole, G. (2010, 07 22). *1st International Conference on Learning Analytics and Knowledge 2011*. Retrieved April 2019, from LAK '11: https://tekri.athabascau.ca/analytics/call-papers

Thirathon, U., Wieder, B., Matolcsy, Z., & Ossimitz, M. (2017). Big Data, Analytic Culture and Analytic-Based Decision Making - Evidence from Australia. *Procedia Computer Science, 121*, 775-783.

Thompson, D. (2016). Marks should not be the focus of assessment - But how can change be acheived? *Journal of Learning Analytics, 3*(2), 193-212.

Towne, T. (2018). *Exploring the phenomenon of secondary teachers integrating the LMS Canvas in a blended-learning course.* PhD Thesis, Liberty University.

Trede, F., Macklin, R., & Bridges, D. (2012). Professional identity development: a review of the higher education literature. *Studies in Higher Education, 37*(3), 365-384.

Tversky, A., & Kahneman, D. (1981, January). The Framing of Decisions and the Psychology of Choice. *Science, 211*(4481), 453-458.

Valtonen, T., Sointu, E. K., Kontkanen, S., Lambert, M. C., & Mäkitalo-Siegl, K. (2017). TPACK updated to measure pre-service teachers' twenty-first century skills. *Australasian Journal of Educational Technology, 33*(2), 15-31.

Venkatesh, V., Morris, M., Davis, G., & Davis, F. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425-478.

Viberg, O., Hatakka, M., Balter, O., & Mavroudi, A. (2018). The current landscape of learning analytics in higher education. *Computers in Human Behaviour, 89*, 98-110.

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APPLYING MACHINE LEARNING TO CLASSIFY PLAYERS IMPORTANCE IN THE NBA

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ABSTRACT

Players win or lose as a team. However, individual players play important role in promoting teams and in advertisement. It is an important task to identify best players. This research attempts to use machine learning to predict a player level of importance following the CRISP (Cross-Industry Standard Process for Data Mining) method and WEKA (Waikato Environment for Knowledge Analysis) software. The research collects and cleans the 2018-19 regular season performance data from NBA.com and ESPN.com for 601 players. The features used for machine learning are games played, games started, minutes played, points scored, offensive rebounds, defensive rebounds, rebounds, assists, steals, blocks, turnovers, assists to turnover ratio, player efficiency and NBA's real plus minus (RPM) statistic. The RPM statistic, computed by sport analysts, is used to classify player's importance with values: High (H) with RPM of +1.51 and above; Average (A) with 0 to +1.50; Low (L) with -0.01 to -3; and Very Low (VL) with -3.1 and lower. Using 10-fold cross-validation machine learning technique, the Logistic, Support Vector Machines, and Random Forest machine learning algorithms perform relatively well with a classification accuracy of 68%, 67%, and 66%, respectively; compared to 25% accuracy for a random guess. With more data, from other seasons, a better accuracy can be achieved. When new performance data come, the classifier models predict players' importance level without the involvement of sport analysts. This allows Teams to know who the most important players are and therefore, know who their most marketable players are.

INTRODUCTION

Interest in the application of analytics in sports has been on the rise for the last several decades (Coleman, 2012; Fry & Ohlmann, 2012; Fialho, Manhaes, & Teixeira, 2019). Sports has always been a way to calm your mind, tone your body, and relax. It is a fun way to just run and enjoy entertainment around friends and loved ones. Sports has been very important socially and economically (Fernández-Gavira, Gálvez-Ruiz, García-Fernández, & García-Villar, 2016). With the world constantly being innovated by individuals, science has found its way into sports. Although some individuals particularly the older generation feel as though it is killing the fun in sports. Even scout evaluations are no longer consistent in determining how good or bad players are. Thus, sports analytics was born. Sports analytics has been applied in various ways to better the field of sports by managing the huge volume of data generated and making use of it by the application of modern computerized techniques (Sarlis & Tjortjis, 2020; Schumaker, Jarmoszko, & Labedz Jr., 2016). With sports analytics, managers and GM's search for contract friendly players that are overlooked by other teams. Most of the time those players are overlooked because they may only excel at one intangible and nothing else. Managers can plug in these one-dimensional players into their comfort zones and watch them excel. Sports analytics also provides invaluable decision support on how athletes are valued in said market. For example, with sport view cameras analysist can capture both video and audio data at the same time. They pick up every single piece of player movement. With the data processed in real time, data analysts can create metric charts for teams and players to use to help better their game or game plan. Devices such as wearable tech are also used to gather data on players movement, heartrate and various movements that show how hard a player is working.

In this research, an effort has been made to experiment on the classification of players' importance using different machine learning algorithms into high to low. Players who are classified to the "High" importance class would be the most marketed players in the NBA. NBA makes their money off token players' contribution to a team. These players boost ticket sales, increase the amount of people tuning into games played on television, sell merchandise, etc.

LITERATURE REVIEW

Machine-learning is currently ubiquitous and is in use in almost every domain, including sports (Carpita, Ciavolino, & Pasca, 2019; Schauberger & Groll, 2018).Various machine learning algorithms have been in use in sports analytics including Bayesian, Logistics, Artificial Neural Networks, Support Vector Machine, and Fuzzy Logic (Fialho, Manhaes, & Teixeira, 2019). Machine learning has been in use in sport result prediction, and in determining importance of teams and players. Hubacek, Sourek, & Zelezny (2019) experiment on how machine learning can be used to exploit sports betting market and show that machine learning methods yield positive cumulative profits using

NBA data from seasons 2007-2014. Bunker and Thabtah (2017) outline a framework with a detailed review of machine learning with a focus on the application of Artificial Neural Networks (ANN) to sports result prediction. The New York Times used machine learning techniques to create a breakdown of what NFL coaches should do on fourth down, whether it's punting, kicking a field goal, or simply going for it (Harris, 2015). The sport prediction problem is normally a classification problem winning, losing, or drawing being the target variable (Bunker & Thabtah, 2019). Sports results prediction is becoming increasingly popular because club owners and managers want to find classification models that can help them in formulating their plans on winning matches. These classification models are created based on player performance indicators, information gathered on the opposition's strategies, results of historical matches, etc.

The use of new wearable devices and other performance tracking technologies have made it possible to make data-driven evaluation of players. Sports data can be acquired in various ways based on events taking place and movement of players in a game (Stein, et al., 2017). Stein et al. (2017) provide a framework for the computation of player performance rating based on performance features such as numbers of passes, shots, goals, and yellow cards. The team performance is measured by analyzing data such as goals, possession, shots, among others.

In soccer, there are several works. Schumaker, Jarmoszko, and Labedz Jr. (2016) show how a premier league winner can be predicted from tweets by way of sentiment analysis, i.e., looking for signals in tweets that help predict match outcomes. Pappalardo et al. (2019) provide a detailed analysis of the application of machine learning for the ranking of soccer players. This work is the closest to this research that focuses on using machine learning to predict NBA players into importance classes: High, Average, Low, and Very Low, based on their performance with the intention of identifying players for the purpose of team promotion.

METHODOLOGY

The goal of this paper is to explore machine learning algorithms for the classification of NBA players into importance classes, "High", "Average", "Low", or "Very Low" . The research question is: Can Machine Learning algorithm effectively determine or classify player importance?

The methodology used follows the standard CRISP-DM (Cross Industry Standard Process for Data Mining) methodology (Shearer, 2000; Bunker & Thabtah, 2019). Bunker & Thabtah (2016) propose sport result prediction framework, SPR-CRISP-DM, following the traditional CRISP-DM model. The method of research is a well-proven, structured approach to planning and executing a data mining project. The process consists of 6 phases, that are somewhat interchangeable and can always be revisited and reevaluated after completed. The phases are: domain/business understanding, data understanding, data preparation/feature extraction, modeling, evaluation and deployment.

Following the CRISP-DM model, an effort is made to understand the characteristics of basketball, player performance metrics, team performance metrics, among others. Players performance data of 2018-19 season were gathered from nba.com and espn.com. After data acquisition, preprocessing which includes data cleaning and feature extraction were done. A total of 601 players performance data was used in the modeling process. Figure 1 shows sample records of the dataset. WEKA was used as a tool for preprocessing and data mining activities.

Figure 8. *Five records of the dataset*

Name	GP	GS	MIN	PTS	OR	DR	REB	AST	STL	BLK	TO	PF	AST/TO	PER	RPM	IMP_CLASS
xxxxxxx	77	77	36.9	28	1.4	6.8	8.2	4.1	2.2	0.4	2.7	2.8	1.6	23.32	7.63	VH
xxxxxxx	78	78	36.8	36.1	0.8	5.8	6.6	7.5	2	0.7	5	3.1	1.5	30.62	7.42	VH
xxxxxxx	69	69	33.8	27.3	0.7	4.7	5.3	5.2	1.3	0.4	2.8	2.4	1.9	24.45	6.84	VH
xxxxxxx	72	72	32.8	27.7	2.2	10.3	12.5	5.9	1.3	1.5	3.7	3.2	1.6	30.95	6.69	VH
xxxxxxx	80	80	31.3	20.1	2.9	8	10.8	7.3	1.4	0.7	3.1	2.9	2.3	26.38	6.48	VH

The predictor features included games played(GP), games started(GS), minutes (MIN), points(PTS), offensive rebounds(OR), defensive rebounds (DR), rebounds (REB), assists (AST), steals (STL), blocks (BLK), turnovers (TO), assists to turnover ratio (AST/TO), player efficiency rating (PER), and importance class (IMP_CLASS). NBA calculates real plus minus (RPM) for each player based on performance data. Importance class (IMP_CLASS) is an

additional field created using RPM. The importance class values include High (RPM >1.51), Average (0<=RPM<=1.50), Low (-3<=RPM<0.01), and Very Low (RPM<-3.1).

Classification algorithms such as artificial neural networks (ANN), Naïve Bayes, Random Forest, Support Vector Machine, Decision Trees, and Logistic Regression were used. A 10-fold cross validation was used to evaluate the performance of the algorithms in assigning players to importance classes.

RESULTS AND DISCUSSION

The response or target variable is importance class. The variables used to predict the importance class of a player are listed above. Figure 2 shows the number of players by importance class. The classes are not balanced, not equal number of players under each class. The scatter plots of paired features using 75% of the dataset is shown in Figure 3.

Figure 2: *Number of Players by Importance Class*

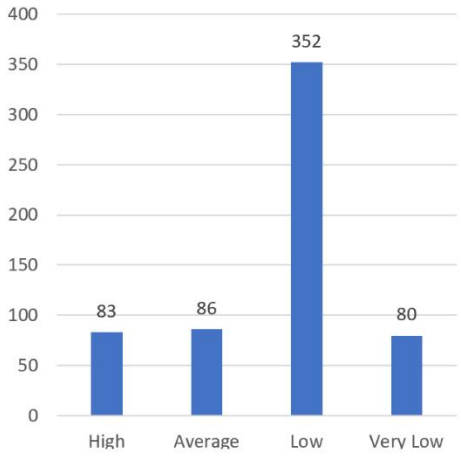
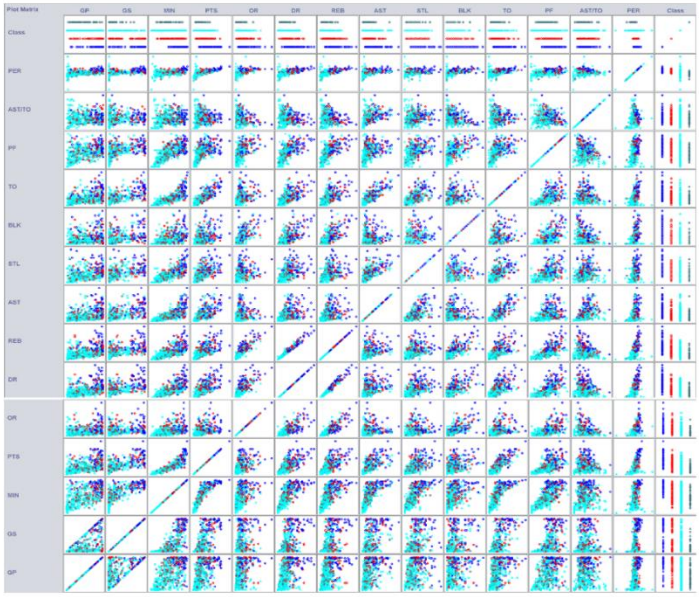


Figure 3: *Scatter Plot of Paired Features*



The research question is that given the predictor features, player performance measures, can we develop a classifier to predict the importance class of a player? We experimented several machine learning algorithms including, artificial neural networks (ANN), Naïve Bayes, Random Forest, Support Vector Machine, and Logistic Regression algorithms on WEKA. The details of the results and the performance of the classifiers used in the experiment are presented below.

Multilayer Perceptron (ANN)

A multilayer perceptron (MLP) is a feedforward artificial neural network that generates a set of outputs from a set of inputs. An MLP is characterized by several layers of input nodes connected as a directed graph between the input and output layers. MLP uses back propagation for training the network. Figure 4 shows the WEKA output. About 67% of the instances are correctly classified.

Figure 4: *Summary of the performance of the Multilayer Perceptron (ANN) Classifier*

```
=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         392               65.2246 %
Incorrectly Classified Instances       209               34.7754 %
Kappa statistic                          0.3641
Mean absolute error                      0.2094
Root mean squared error                  0.3643
Relative absolute error                 69.7168 %
Root relative squared error             94.0851 %
Total Number of Instances              601

=== Detailed Accuracy By Class ===

               TP Rate   FP Rate   Precision   Recall  F-Measure  MCC      ROC Area  PRC Area  Class
               0.639    0.052    0.663      0.639    0.650      0.596    0.907     0.725     H
               0.186    0.068    0.314      0.186    0.234      0.148    0.689     0.265     A
               0.869    0.470    0.723      0.869    0.790      0.431    0.748     0.783     L
               0.213    0.058    0.362      0.213    0.268      0.196    0.743     0.298     VL
Weighted Avg.  0.652    0.300    0.608      0.652    0.621      0.382    0.761     0.637
```

Naïve Bayes Classifier

Naïve Bayes classifiers are a family of simple "probabilistic classifiers" based on applying Bayes' theorem with strong (naive) independence assumptions between the features. Bayes' theorem is a theorem describing how the conditional probability of each of a set of possible causes for a given observed outcome can be computed from knowledge of the probability of each cause and the conditional probability of the outcome of each cause. Naïve Bayes is a simple technique for constructing classifiers: models that assign class labels to problem instances, represented as vectors of feature values, where the class labels are drawn from some finite set. There is not a single algorithm for training such classifiers, but a family of algorithms based on a common principle: all Naïve Bayes classifiers assume that the value of a feature is independent of the value of any other feature, given the class variable.

Figure 5 shows the summary of the performance of the Naïve Bayes algorithm. Close to 49% of the instances are correctly classified. The incorrect classification is higher, 51%. Looking at the performance at class level, the performance was better for High and Very Low classes. One reason could be the size of instances that are classified under Very Low importance class.

Figure 5: *Summary of the Naïve Bayes Classifier*

```
=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         295               49.0849 %
Incorrectly Classified Instances       306               50.9151 %
Kappa statistic                          0.2842
Mean absolute error                      0.2615
Root mean squared error                  0.4288
Relative absolute error                 87.0369 %
Root relative squared error            110.7501 %
Total Number of Instances              601

=== Detailed Accuracy By Class ===

               TP Rate   FP Rate   Precision   Recall  F-Measure  MCC      ROC Area  PRC Area  Class
               0.723     0.081     0.588       0.723   0.649      0.590    0.915     0.691     H
               0.314     0.161     0.245       0.314   0.276      0.138    0.684     0.225     A
               0.452     0.177     0.783       0.452   0.573      0.286    0.737     0.763     L
               0.613     0.263     0.263       0.613   0.368      0.257    0.729     0.283     VL
Weighted Avg.  0.491     0.173     0.610       0.491   0.514      0.303    0.753     0.612
```

Random Forest

Random Forest is an important classifier used in many applications. It is widely trademarked as an ensemble classifier, meaning that it constructs a set of tree classifiers and then classifies new data points by taking a (weighted) vote of their predictions. Random forests are collections of trees that consists of many decision trees and outputs. The random forest classifier correctly classified about 67% of the instances. This was a much better classifier than the Naïve Bayes. Figure 6 shows the WEKA output. The true positive (TP) rate, measure of accuracy, was higher for "Low (L)" and "High (H)") classes.

Figure 6: *Summary of the Performance of the Random Forest Classifier*

```
=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         400               66.5557 %
Incorrectly Classified Instances       201               33.4443 %
Kappa statistic                          0.3437
Mean absolute error                      0.2348
Root mean squared error                  0.3445
Relative absolute error                 78.1571 %
Root relative squared error             88.9582 %
Total Number of Instances              601

=== Detailed Accuracy By Class ===

               TP Rate   FP Rate   Precision   Recall  F-Measure  MCC      ROC Area  PRC Area  Class
               0.590     0.064     0.598       0.590   0.594      0.529    0.922     0.713     H
               0.105     0.037     0.321       0.105   0.158      0.113    0.728     0.292     A
               0.943     0.566     0.702       0.943   0.805      0.454    0.751     0.781     L
               0.125     0.015     0.556       0.125   0.204      0.219    0.761     0.334     VL
Weighted Avg.  0.666     0.348     0.614       0.666   0.603      0.384    0.772     0.642
```

Logistic Regression Classifier

Logistic regression is a binary classification algorithm that assumes the input variables are numeric. The algorithm learns a coefficient for each input value, which are linearly combined into a regression function and transformed using a logistic (s-shaped) function. Logistic regression is a fast and simple technique but can be very effective on some problems. The WEKA implementation of the algorithm has been adapted to support multi-class classification problems. The overall performance of the classifier is 68% with higher true positives for Low and High classes.

Figure 7: *Summary of the Logistic Regression Classifier*

```
=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         410               68.2196 %
Incorrectly Classified Instances       191               31.7804 %
Kappa statistic                          0.3834
Mean absolute error                      0.2215
Root mean squared error                  0.3405
Relative absolute error                 73.7238 %
Root relative squared error             87.9249 %
Total Number of Instances              601

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 0.735    0.052    0.693      0.735    0.713      0.666    0.942     0.782     H
                 0.209    0.037    0.486      0.209    0.293      0.251    0.764     0.315     A
                 0.932    0.550    0.705      0.932    0.803      0.449    0.753     0.788     L
                 0.038    0.015    0.273      0.038    0.066      0.056    0.753     0.275     VL
Weighted Avg.    0.682    0.337    0.615      0.682    0.619      0.399    0.781     0.651
```

Support Vector Machine (SVM) Classifier

Support vector machine is a supervised machine learning method used for classification and regression problems. It can be used for binary as well as multi-class problems. Our data has four classes as described above. Figure 8 shows the output of the WEKA SVM classifier. The overall performance of the classifier is about 68%. This result was achieved when the training data set is standardized.

Figure 8: *Output of the WEKA SVM Classifier*

```
=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         408               67.8869 %
Incorrectly Classified Instances       193               32.1131 %
Kappa statistic                          0.3621
Mean absolute error                      0.2856
Root mean squared error                  0.3643
Relative absolute error                 95.0816 %
Root relative squared error             94.0748 %
Total Number of Instances              601

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 0.699    0.054    0.674      0.699    0.686      0.635    0.916     0.608     H
                 0.151    0.041    0.382      0.151    0.217      0.167    0.689     0.233     A
                 0.957    0.578    0.701      0.957    0.809      0.467    0.692     0.698     L
                 0.000    0.000    ?          0.000    ?          ?        0.729     0.228     VL
Weighted Avg.    0.679    0.352    ?          0.679    ?          ?        0.728     0.556

=== Confusion Matrix ===

   a   b   c   d   <-- classified as
  58  14  11   0 |   a = H
  20  13  53   0 |   b = A
   8   7 337   0 |   c = L
   0   0  80   0 |   d = VL
```

All the tested classifiers performed much better than the Naïve Bayes algorithm. The performance of SVM and Logistic Regression classifiers was higher with 68% overall all accuracy. Considering the four classes, the probability of a player to fall to one of the classes is 25%. All of the classifiers performed better than a random classification, and except the Naïve Bayes algorithm, there is no statistically significant difference in accuracy among the other algorithms (see Figure 9).

Figure 9: *Comparison of the Performance of the Classifiers*

```
Tester:     weka.experiment.PairedCorrectedTTester -G 4,5,6 -D 1 -R 2 -S 0.05 -result-matrix "weka.experim
Analysing:  Percent_correct
Datasets:   1
Resultsets: 6
Confidence: 0.05 (two tailed)
Sorted by:  -
Date:       7/29/19 11:42 AM


Dataset                   (1) bayes.Na | (2) funct (3) funct (4) funct (5) trees (6) trees
----------------------------------------------------------------------------------------------
TestData4CATEGORIES-weka.(100)   49.07 |   67.77 v   66.84 v   63.43 v   56.42 v   66.11 v
----------------------------------------------------------------------------------------------
                              (v/ /*) |   (1/0/0)   (1/0/0)   (1/0/0)   (1/0/0)   (1/0/0)


Key:
(1) bayes.NaiveBayes '' 5995231201785697655
(2) functions.Logistic '-R 1.0E-8 -M -1 -num-decimal-places 4' 3932117032546553727
(3) functions.SMO '-C 1.0 -L 0.001 -P 1.0E-12 -N 0 -V -1 -W 1 -K \"functions.supportVector.PolyKernel -E 1
(4) functions.MultilayerPerceptron '-L 0.3 -M 0.2 -N 500 -V 0 -S 0 -E 20 -H a' -5990607817048210779
(5) trees.J48 '-C 0.25 -M 2' -217733168393644444
(6) trees.RandomForest '-P 100 -I 100 -num-slots 1 -K 0 -M 1.0 -V 0.001 -S 3' 1116839470751428698
```

CONCLUSION AND FUTURE RESEARCH

The experimental result show that the Naïve Bayes classifier performed significantly lower than all other classifiers. Logistic Regression, Support Vector Machine, Random Forest and Multilayer Perceptron (ANN) classifiers performed well in that order. However, the performance difference is not significantly different at 5% significance level. For predicating the most important players, high importance class: Logistic (68%) and SVM/SMO (67%) do well.

The data we dealt with has imbalanced classes. The approach can be improved by incorporating ways to handle such problems - imbalanced class problem. Furthermore, the experiment can be repeated with more datasets by adding several seasons NBA players performance data. We believe that the performance would improve with the addition of more data as it allows the classifiers to train better with more data.

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REFERENCES

Bunker, R. P., & Thabtah, F. (2019). A machine learning framework for sport result prediction. *Applied Computing and Informatics, 15*, 27-33.

Carpita, M., Ciavolino, E., & Pasca, P. (2019). Exploring and modelling team performances of the Kaggle European Soccer database. *Statistical Modelling, 19*(1), 74–101.

Coleman, B. J. (2012, March). Identifying the "Players" in Sports. *Interfaces, 42*(2), pp. 109-118.

Fernández-Gavira, J., Gálvez-Ruiz, P., García-Fernández, J., & García-Villar, J. (2016). Research and analysis in sport economics and management. *Revista de Psicología del Deporte, 25*(Suppl 1), 9-10.

Fialho, G., Manhaes, A., & Teixeira, J. P. (2019). Predicting Sports Results with Artificial Intelligence – A Proposal Framework for Soccer Games. *164*, 131-136.

Fry, M., & Ohlmann, J. (2012, March). Introduction to the Special Issue on Analytics in Sports, Part I: General Sports Applications. *Interfaces, 42*(2), pp. 105-108.

Harris, D. (2015, February 12). *Here's more evidence that sports is a goldmine for machine learning*. Retrieved from Gigaom : https://gigaom.com/2015/02/12/heres-more-evidence-that-sports-is-a-goldmine-for-machine-learning/

Hubacek, O., Sourek, G., & Zelezny, F. (2019). Exploiting sports-betting market using machine learning. *International Journal of Forecasting, 35*, 783-796.

Pappalardo, L., Cintia, P., Ferragina, P., Massucco, E., Pedreschi, D., & Giannotti, F. (2019). PlayeRank: Data-driven Performance Evaluation and Player Ranking in Soccer via a Machine Learning Approach. *ACM Transactions on Intelligent Systems and Technology, 59*(5), 1-27.

Sarlis, V., & Tjortjis, C. (2020). Sports analytics — Evaluation of basketball players and team. *Information Systems, 93*.

Schauberger, G., & Groll, A. (2018). Predicting matches in international football tournaments with random forests. *Statistical Modelling, 18*(5-6), 460–482.

Schumaker, R. P., Jarmoszko, T. A., & Labedz Jr., C. S. (2016). Predicting wins and spread in the Premier League using a sentiment. *Decision Support Systems, 88*, 76-84.

Shearer, C. (2000). The CRISP-DM Model: The New Blueprint for Data Mining. *Journal of Data Warehousing, 5*(4), pp. 13-22.

Stein, M., Janetzko, H., Seebacher, D., Jäger, A., Nagel, M., Hölsch, J., . . . Grossniklaus, M. 2. (2017). How to Make Sense of Team Sport Data: From Acquisition to Data Modeling and Research Aspects. *Data, 2*(1), 1-23.

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DETECTING COMMONALITIES IN ASSET MANAGEMENT BUDGET JUSTIFICATIONS

David Lanter, Temple University & CDM Smith

ABSTRACT

This paper explains how an ontology-based object-oriented processing application and database system can be implemented to process asset management work order budget justifications to detect and analyze patterns of commonality of their business cases. Central to this effort is incremental creation of an asset management budget justification ontology, followed by implementation as a global object-oriented data model that supports comparative analysis of budget justifications for individual asset management work orders. Focused on the Operations & Maintenance (O&M) business function, this research suggests a way to achieve a unified standard language and suite of intelligent tools for helping businesses analyze and understand justifications for asset management work order investments within and among an organization's business functions.

ONTOLOGY

In philosophy, ontology is the study of common characteristics of all things with the intent of providing an explanation of the universe through a comprehensive categorization based on their similarities and differences. In artificial intelligence, an ontology is a data structure that organizes knowledge as a semantic network of terminology expressing relationships among concepts conveying meaning with standardized vocabulary for a specialized field. The ontology is used in natural language processing research to guide automatic unsupervised parsing and transformation of text into a data representation of meaning.

To be useful, however, the representation of meaning must enable automated reasoning capabilities that help solve practical problems. The information inherent in asset management work order justifications can be used to build an ontology-based information system (Figure 0) consisting of:

1. A semi-automated parser able to extract meaning from work order justification texts
2. A knowledge representor that transforms and structures this meaning to improve the ontology and persist the meaning into a corresponding object-oriented database
3. A semantic pattern detection and visualization application that queries and processes the work order justification database to find and visualizes salient commonalities and differences that aid understanding.

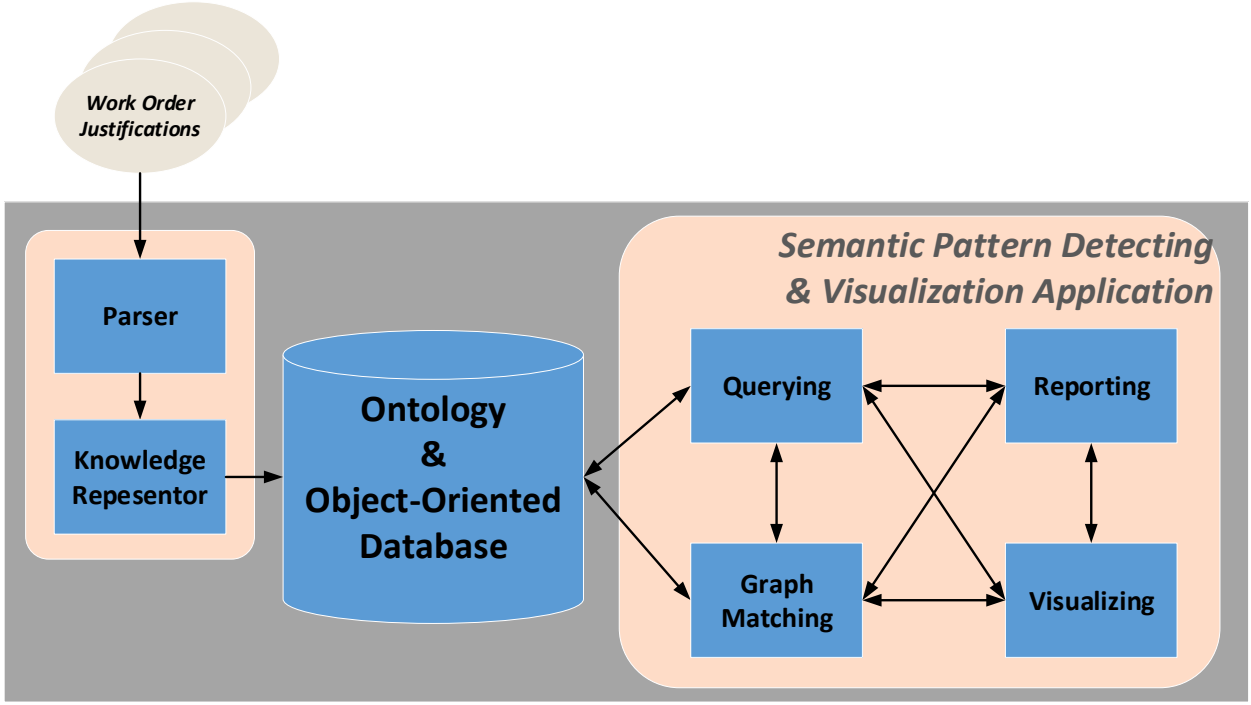

Figure 0. Ontology-based information system.

An ontology is created by consensus to provide an organization with an agreed on formal specification that facilitates communication, reasoning, and sharing knowledge. The organization's commitment to an ontology provides a shared vocabulary used in a consistent manner that assures meaningful communication. The resulting ontology supports development of an enterprise data model, enables automated reasoning and visualizations that provide insights into the business cases expressed in work order justifications and their alignment with business line and organizational objectives, and a way to automate information sharing among networked computers.

TOWARDS A WORK ORDER JUSTIFICATION ONTOLOGY

In an ideal world, an organization would be able to look and find and reuse a previously crafted off-the-shelf ontology (Nguyen, V. 2011, p. 36) for automating parsing justification text and reasoning about and detecting commonalities among of the work order budget justifications. An ontology, however, is designed on purpose for a certain application running in a specific context. This makes existing ontologies created by others possibly useful to those who lack knowledge of a subject area. The generic concepts and language expressed in the ontologies of others, however, are not likely well matched to a well-established business' concepts, terminology, values and objectives of each of its business areas.

Use of an externally defined ontology in an automated parser would result in processing that results in failed determinations of valid commonalities in work order justifications (i.e. false positives and false negatives). This would be due to ontological mismatch between the language and concepts encoded within the off-the-shelf ontology and the meaning expressed in the justification written by the organization's work order justification author. That is, mismatch would result from use of different terms representing the same concept and the same terms for different concepts, and concepts expressed in the justification completely missing from the off-the-shelf ontology.

For example, many of the fourteen published ontologies analyzed by Sinha and Dutta (2020) included semantic representations of environmental contexts (i.e. water bodies, watersheds, flood plains, and floods), instruments and sensors. While one ontology of the fourteen included electrical assets, none of the other ontologies' examples included the wide-range of flood control assets which are central to the Operations and Management (O&M) work order budget justifications of flood management organizations.

Large well-established businesses in a particular infrastructure sector (CISA 2020) have likely developed, improved and evolved their own shared conceptualizations, terminology, objectives and values over decades (and in a few cases over centuries) as their experts established the domain of infrastructure asset management of their sector. These conceptualizations and terminology are expressed in work order justifications of asset management expenditures. They can be formalized within a work order justification ontology. This would address problems of synonyms, homonyms and omissions in terminology. It would also provide a basis for developing automated reasoning capabilities able to identify similarities and patterns (Reul, Q.H. 2012) in justifications written by organizational staff which often are found in subsumed (i.e. subset) and disjoint relationships among concepts expressed in specialized language of O&M work order justifications. An O&M work order ontology will also provide a basis for comparison and learning from the ontologies of other critical infrastructure asset management experts and researchers.

This research is focused on the design of a prototype O&M work order budget justification ontology and prototype computer application capabilities for analyzing, finding, visualizing and aiding explanation and understanding of commonalities and differences among O&M work order justifications. The resulting ontology, parser, and corresponding object-oriented analytical application and database would enable insights into the state of an organization's infrastructure, as well as detecting and removing redundancies, conflicts and inefficiencies; and improving coordination and synergies among related work orders and the larger projects they may be part of.

ONTOLOGY DESIGN

Abstraction is the principle tool of ontology design. The designer selects important characteristics and properties of objects and ignores others determined to be not relevant. This cognitive process helps the designer understand, classify and model reality. Ontology design utilizes three non-overlapping primitive abstraction mechanisms: classification, aggregation, and generalization.

Classification is used to define a single concept as a class of real-world objects characterized by common properties. It makes explicit the IS-MEMBER-OF semantic relationship existing among a set of similar objects.

Aggregation is used to define a new class from a set of other classes that represent its constituent parts. It makes explicit the WHOLE-PART or IS-PART-OF relationship between a composite object and the set of its required and optional component objects. The IS-PART-OF relationship is a logical "AND" relationship between the composite object and its component parts.

Generalization is used to define a subset relationship between elements of two or more classes. It makes the IS-A relationship between a superclass (i.e. generalization) and its subset classes (i.e. specializations). The IS-A relationship is a logical "OR" relationship between the instance of the superclass and the alternative specializations. The properties defining the characteristics of the generic superclass are inherited by all the specialized subclasses.

Building a machine processible ontology for analytical reasoning about work order justifications is a gradual process of building and integrating conceptualizations of infrastructure assets and their business cases and lifecycles. This activity enables the designer's perception of the reality of the informational domain of each business-line is progressively enriched and refined as the ontology is incrementally developed. This process is typically organized using strategies based on structured transformations. 'Top-down' and 'bottom-up' are basic strategies which are used within the more pragmatic and efficient 'mixed' approach. The top-down strategy refines abstract concepts into more concrete ones. Bottom-up, in contrast, creates abstract classifications, aggregations, and generalizations from concrete classes of objects.

Top-down Design

Top-down design produces a final ontology through structured decomposition. That is, a single concept is transformed into a more detailed specification. Systematic application of the top-down design primitives adds new details to the original conceptualization. The design process ends when all asset life-cycle and business-line work-order justification concepts have been included as details in the resulting ontology. All concepts are present at each step in a pure top-down approach. That is, no new abstract concepts are considered. Only additional detail is added to the starting concepts in the ontology. This is only possible, however, for a designer possessing an a priori high-level understanding of the asset life-cycle and business-line work-order justification concepts.

The top-down design primitives each apply to a single concept and produce a more detailed description. The following primitives are used to transform a starting ontology into a more detailed one:

- Refine a class of objects into a relationship between two more classes
- Refine a class into a generalization hierarchy or a subset
- Split a class into a set of independent classes. The effect of this primitive is to introduce new classes, not to establish relationships or generalizations among them
- Refine a relationship into two (or more) relationships among the same classes
- Refine a relationship into a path of classes and relationships. Applying this primitive corresponds to recognizing that a relationship between two concepts should be expressed via a third concept, hidden in the previous representation
- Refine a class by introducing properties
- Refine a class by introducing a composite property
- Refine a simple property either into a composite property or into a group of properties

Bottom-up design

Bottom up design introduces conceptualization on the application domain that were not captured at any level of abstraction by the previous version of the ontology. This approach is the reverse to that of top-down design. The bottom-up primitives introduce new concepts and properties previously missing from the ontology. This approach is a simple one where one part of the problem is attacked at a time. It results in a sequence of gross restructuring as complex intermediate design ontologies are integrated. The bottom-up primitives are applied to a set of elementary concepts to combine them and build up more complex ones. The bottom-up primitives are:

- Generate a new class to represent a concept with specific properties not expressed in the ontology

- Generate a new relationship between existing classes
- Create a new object that is a generalization for previously defined classes
- Generate a new property and incorporate it in a previously defined class
- Create a composite property and incorporate it into a previously defined class

Mixed Design Strategy

The mixed design strategy is useful when the concepts forming the domain are complex. It makes use of the best parts of both the top-down and bottom-up approaches. Mixed design begins with a top down approach to produce a skeleton ontology. Based on an understanding of basic relationships among important concepts expressed in the information domain gained from prior work, the designer begins partitioning the concepts into subsets. The partitioned concepts are examined and the most important are placed within the skeleton ontology and systematically linked to integrate the concepts within the partitions. The utility of the resulting skeleton ontology is in its expression of the underlying structure and organization of the informational domain. A well-designed skeleton ontology serves as a core providing ease to subsequent elaboration and evolution of the ontology through bottom-up integration of new conceptualizations.

The resulting ontology provides semantic structure for understanding concepts of the domain. It can also support development of an input parser able to recognize and extract the expression of the concepts in texts. The ontology can serve as a model to follow for implementing a corresponding object-oriented schema for an application to use in processing instance data extracted by the parser, persisting within a database, and analyze to solve problems including detecting and analyzing commonalities and differences and identifying and helping explain patterns within work order justifications.

ONTOLOGY FOR O&M WORK ORDER JUSTIFICATIONS

The work order object types and relationships presented in this paper represent a preliminary working hypothesis of concepts and terminology central to O&M work order justifications. A skeleton ontology for the O&M work order justifications may be formulated from the following general conceptualization:

A justification for a work order's budget typically includes a description of a ***Solution*** to resolve an ***Issue(s)*** affecting a infrastructure ***Asset(s)*** and characterized by a ***Symptom(s)*** that is needed to mitigate or facilitate a negative or positive ***Impact(s)***.

The elements structured within an ontology are referred to as subjects or objects and relationships. A classification of objects typically expressed in an O&M work order justification include: Asset(s), Component(s), Issue(s), Symptom(s) Impact(s), and Solution(s). These are defined in Figure 1.

Asset	An infrastructure asset
Component	A component (or subunit) of an asset
Issue	Condition affecting performance of an asset. (If the effect on performance is negative, the issue is either a defect or deficiency. If the affect is positive, however, the issue may be an opportunity to improve performance of the asset.)
Symptom	A physical indication of a condition of defect or deficiency, or opportunity for improvement
Impact	A negative consequence likely to happen as a result of the issue's effect on an asset, or a positive consequence (benefit) likely to happen as a result of resolving the issue
Solution	Solution proposed to resolve a asset issue and improve the asset's performance

Figure 1. Example Subjects and their definitions.

OBJECT-ORIENTED IMPLEMENTATION

The subjects/objects expressed in the relationship predicates of the ontology developed for parsing the text of O&M work order justifications can also be expressed as an object-oriented data model (i.e. schema). This schema can be implemented to:

1. Store work order justification instance data as objects in working memory of a computer application to support inferencing, analysis and display at runtime
2. Store work order justification instance data as objects in a database to persist for reuse within the application at later times

Object-oriented applications and databases provide mechanisms for efficiently creating, processing, and querying composite-component and generalization-specialization relationships.

Composite-Component Relationships

In aggregation a "whole-part" or "a-part-of" association is established using a logical AND relationship between a composite object and its component objects. Aggregation supports recursive transitive composite-component relationships among constituent objects. That is, a composite work order justification object has its component objects, each of which may in in turn have its own component objects. Anyone of these components may be composites with their own components, and so on.

The semantics of composite reference are further refined on basis of whether an object is part of only one object or more than one object. This leads to two types of composite reference: exclusive or shared. An exclusive composite reference from an object X to another object Y means that Y is part of only X. A shared composite reference from X to Y means that Y is a part of X and possibly other objects. Shared composite references can be established to merge and unify justifications based on commonalities detected in their assets, issues, symptoms, impacts, or solutions.

The World Wide Web Consortium's (W3C) Web Ontology Language (OWL) and Resource Description Framework (RDF) provide specifications for creating metadata models and general software methods for encoding, querying, interpreting, and using ontologies. RDF will be used here to describe the use of "Relationship Predicates" for specifying relationships connecting subjects and objects in ontologies. This is similar to the classical conceptual modeling approaches such as Chen's Entity-Relationship (Chen 1976), Object-Oriented Design (Booch 1991, Rumbaugh et al. 1991) and Unified Modeling Language (UML) for encoding relationships among entities and objects in data models and schemas.

RDF makes statements about relationships between concepts in the form: **subject-predicate-object,** which is known as **triples**. In an RDF triple, a subject denotes a concept. Object denotes a related trait, aspect, characteristic or property of the subject. The object can be a subject in another RDF triple. Predicate expresses the relationship between the subject and its object. This is illustrated in Figure 2.

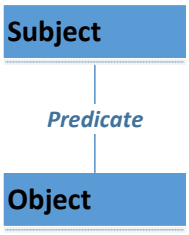

Figure 2. Predicate expresses a relationship between a subject (i.e. concept) and a related object (i.e. trait, aspect, characteristic or property of the subject.)

An object in one predicate may be the subject in another predicate relationship. This is illustrated in Figure 3.

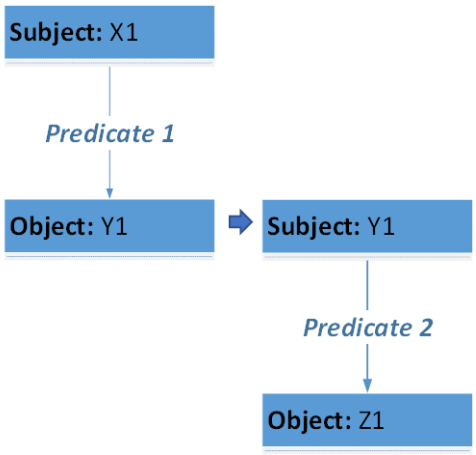

Figure 3. Illustration of an object in one Predicate 1 being the subject in Predicate 2.

A sequence of predicates can be used to expresses transitive relationships among concepts. Navigating across transitive relationships enables associative inferencing. For example, Figure 4 illustrates the transitive association: If Z1 is a property of Y1 as established by Predicate 2, and Y1 is a property of X1 via Predicate 1, then Z1 is also a property of X1.

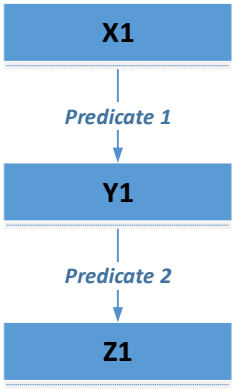

Figure 4. Predicate 1 associates X1 with Y1, Predicate 2 associates Y1 with Z1, and navigation across both predicates enables transitive association of X1 and Z1 through Y1.

A collection of RDF statements can express an ontology as a labeled directed multi-graph of associations known as a semantic network. The semantic network is an artificial intelligence knowledge representation which is both human and machine readable. Semantic networks support intuitive visual displays and automated inferencing algorithms based on network traversal.

Three general relationship predicates can be used to associate Asset, Component, Issue, Symptom, Impact, and Solution as subjects and objects to form a central skeleton for a O&M work order justification ontology on which to build up details. These are: “Has a”, “Affected by”, “Has risk of”, “Characterized by”, and “Mitigated by” and are defined in Figure 5.

"Has a"

Subject (**Asset**), Predicate (**Has a**), Object (**Component**)

"Affected by"

Subject (**Asset**), Predicate (**Affected by),** Object (**Issue**)
Subject (**Component**), Predicate (**Affected by),** Object (**Issue**)

"Has risk of"

Subject (**Issue**), Predicate (**Has risk of**), Object (**Impact**)

"**Characterized by"**

Subject (**Issue**), Predicate (**Characterized by**), Object (**Symptom**)

"Mitigated by"

Subject (**Issue**), Predicate (**Mitigated by**), Object (**Solution**)

Figure 5. General relationship predicates for connecting the subjects and objects found in O&M work order justifications.

The basic elements for a prototype O&M work order justifications skeletal ontology are subjects and objects illustrated as labeled boxes in Figure 6 and relationship predicates depicted with as labeled links connecting the subjects and objects in an aggregation to form a Work Order Justification object.

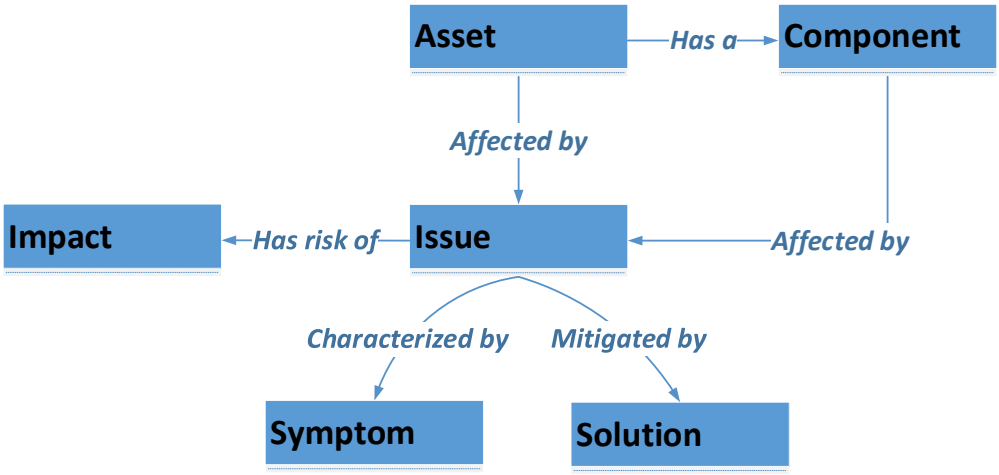

Figure 6. Central concepts (i.e. subjects/objects and relationships) aggregated to form an O&M work order justification.

Generalization-Specialization Relationships

Generalization is useful for modeling similarities and differences among concepts and the object data classes used to represent them in an application's memory and persistent datastore. The generalization, or class being refined, is sometimes referred to as the superclass, and each refined specialized version is a subclass. Generalization establishes a logical OR relationship been the more refined subclasses.

A generalization is sometimes called an "Is-A" semantic relationship because each instance of a subclass is also instance of the superclass. Properties and operations common to a set of subclasses are attached as 'generalized' features to the superclass. These features are shared through inheritance by each subclass. Each subclass inherits the features of its superclass(es) and refines or specializes them by adding their own specific properties and operations. The inheritance of generalized features is transitive across an arbitrary number of generations of subsequent subclass refinements of the original superclass. As a direct result of transitive closure, an instance of a subclass is

simultaneously an instance of all its ancestor classes in a generalization hierarchy. That is, all ancestor class attributes and operations apply to the subclass instances.

Generalization-specialization relationships enable further elaboration of the subject/object classes and semantic relationships that comprise the skeletal schema to provide an organizing framework for structuring properties pertaining to work order justifications and storing the values for the properties. Analysis of O&M work order justifications identifies opportunities to further elaborate the Solution component of the skeletal work order justification ontology and schema with semantics and specialized subclasses for expressing and storing unique property values common to: Evaluation work orders, Repair work orders, Replacement work orders, Improvement work orders, and Augmentation work orders.

Below are RDF relationship primitives for adding the "Is-A" relationship to augment the skeletal ontology for expressing an OR relationship that differentiates among different types of work order justification solutions:

- Subject (**Solution**), Predicate (**Is a**), Object (**Evaluation**)
- Subject (**Solution**), Predicate (**Is a**), Object (**Repair**)
- Subject (**Solution**), Predicate (**Is a**), Object (**Replacement**)
- Subject (**Solution**), Predicate (**Is a**), Object (**Improvement**)
- Subject (**Solution**), Predicate (**Is a**), Object (**Augmentation**)

Examples of O&M work order justifications found in work orders of public works utilities often include alternate solutions illustrated in Figure 7 and which can be read "…a solution offered by a work order 'is a' evaluation, repair, replacement, improvement, or augmentation; and an evaluation 'is a' Regulatory Compliance evaluation, Hydraulic Analysis evaluation, or an evaluation of Alternative Options."

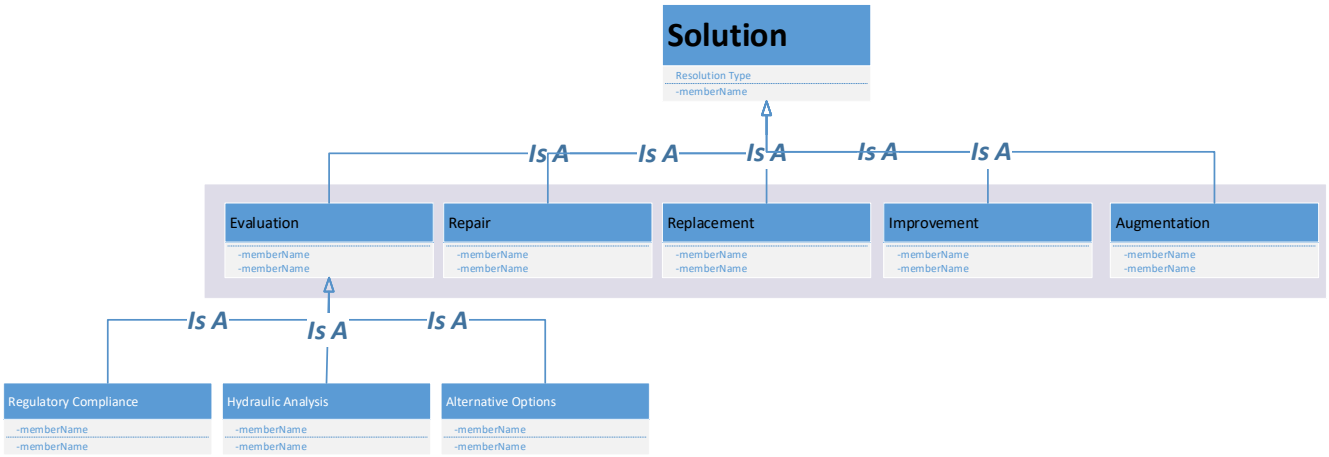

Figure 7. The generalized Solution superclass and its specialized subclasses for storing attributes unique to Evaluation, Repair, Replacement, Improvement, and Augmentation work orders.

Below are two RDF relationship predicates for expressing semantics of defect and deficiency issues:

- Subject (**Issue**), Predicate (**Is a**), Object (**Defect**)
- Subject (**Issue**), Predicate (**Is a**), Object (**Deficiency**)

Figure 8 illustrates the Issue generalization and two subclasses for storing different information pertaining to defects versus deficiencies.

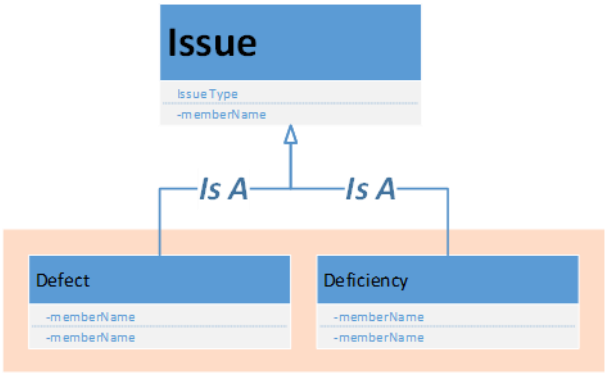

Figure 8. The generalized Issue superclass and its specialized subclasses for storing different properties for describing Defects versus Deficiencies.

Below are two RDF relationship predicates for different types of assets referenced in work order justifications:

- Subject (**Asset**), Predicate (**Is a),** Object (**Geographic Feature**)
- Subject (**Asset**), Predicate (**Is a),** Object (**Facility – Constructed Asset**)

Figure 9 illustrates two general types of assets: geographic features and constructed facilities.

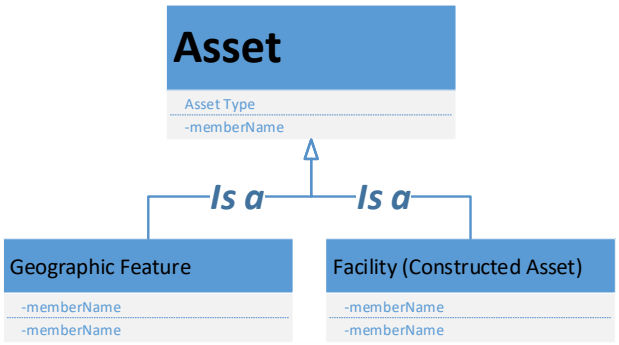

Figure 9. The generalized Asset superclass and its specialized subclasses for storing different properties of Geographic Features and Facilities (Constructed Assets).

Figure 10 illustrates a work order justification ontology expressed as a Unified Modeling Language (UML) data model ('schema') based on aggregation and generalization relationships. The UML schema captures and structures semantics for serving as a:

1. Ontology able to support parsing justification texts
2. Schema able to support development of
    a. A database for storing justification datasets, and
    b. An application object able to process justification datasets to detect commonalities and patterns among work order justifications, and for developing a database for storing the justification data

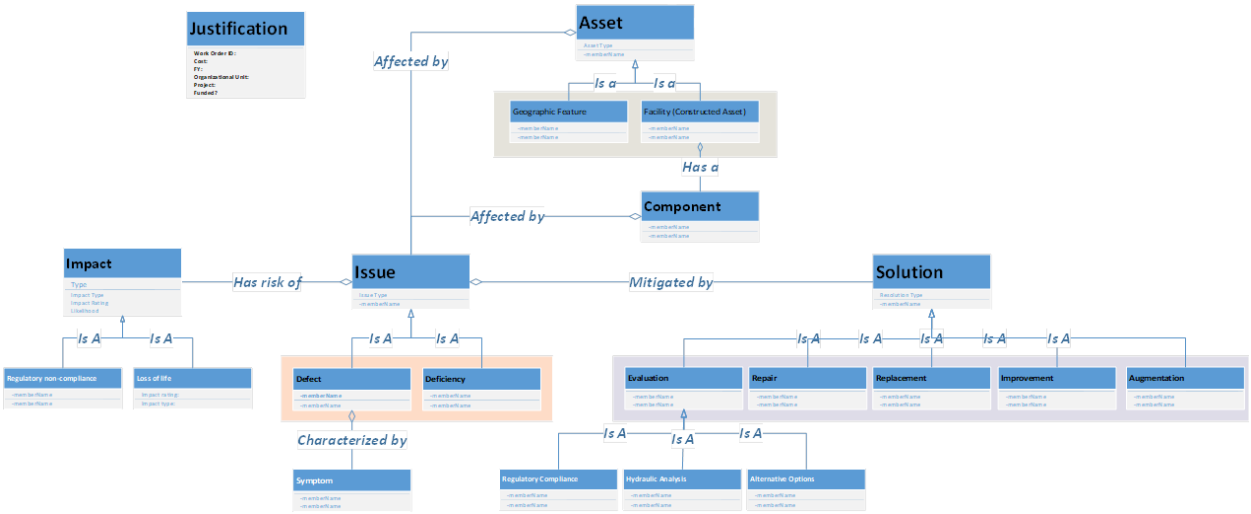

Figure 10. A prototype work order justification ontology expressed as a Unified Modeling Language (UML) schema based on aggregation (displayed with diamonds) and generalization (displayed with triangles) relationships.

WORK ORDER JUSTIFICATION EQUIVALENCE AND SIMILARITY

The O&M work order justification ontology can be expressed as a skeletal database schema illustrated in Figure 10. Implementation as an object-oriented database schema enables combined use of schema navigation and graph matching in an application capability for automatically comparing the instance data of two work order justifications to determine if they are equivalent or similar. Determining ontological equivalence and similarity among work order justification instance datasets is made possible by a schema graph matching capability that examines and detects equivalence and similarity in their Assets, Components, Impacts, Issues, and Solutions.

That is, two justifications are equivalent if their:
Assets are equivalent + **Issues are equivalent** + **Impacts are equivalent** +**Solutions are equivalent**

The work order justification knowledge representation, describes the semantic relationships among Assets, Component, Issues, Symptoms, Impacts, and Solutions justifying proposed O&M investments denoted by S. It is a logical description of the work order justification object-oriented database. It consists of nodes representing work order justification object types $\underline{O}$, and a set of semantic link types (i.e. relationships) $\underline{R}$:

$$S = (\underline{O}, \underline{R})$$

Let O_i denote a justification object type, $\underline{O} = \{O_i: i = \text{Asset, Component, Issue, Symptom, Impact, Solution, Geographic Feature, Facility (Constructed Asset), Evaluation, Repair, Replacement, Improvement, Augmentation, Regulatory Compliance, Hydraulic Analysis, and Alternative Options}\}$

Semantic relationship types, $\underline{R}$, link these objects to structure the conceptualizations expressed in a work order justification. Let R_j denote a link type, $R = \{R_j: j= \text{Has a, Affected by, Has risk of, Characterized by, Mitigated by, Is a}\}$.

Each R_j is defined as a set of ordered pair of objects O_{j1} and O_{j2} such that $R_j = (O_{j1}, O_{j2})$ where $R_j \in \underline{R}$ and $O_{j1}, O_{j2} \in \underline{O}$.

$R_{\text{Has a}} = \{(O_{\text{Asset}}, O_{\text{Component}})\}$
$R_{\text{Affected by}} = \{(O_{\text{Asset}}, O_{\text{Issue}}), (O_{\text{Asset}}, O_{\text{Component}})\}$
$R_{\text{Has risk of}} = \{(O_{\text{Issue}}, O_{\text{Impact}})\}$
$R_{\text{Characterized by}} = \{(O_{\text{Issue}}, O_{\text{Symptom}})\}$
$R_{\text{Mitgated by}} = \{(O_{\text{Issue}}, O_{\text{Solution}})\}$
$R_{\text{Is a}} = \{(O_{\text{Solution}}, O_{\text{Evaluation}}), (O_{\text{Solution}}, O_{\text{Repair}}), (O_{\text{Solution}}, O_{\text{Replacement}}), (O_{\text{Solution}}, O_{\text{Improvement}}), (O_{\text{Solution}}, O_{\text{Augmentation}}), (O_{\text{Asset}}, O_{\text{GeographicFeature}}), (O_{\text{Asset}}, O_{\text{Facility(ConstructedAsset)}}), (O_{\text{Evaluation}}, O_{\text{RegulatoryCompliance}}), (O_{\text{Evaluation}}, O_{\text{HydraulicAnalysis}}), (O_{\text{Evaluation}}, O_{\text{AlternativeOptions}}), \}$

TRANSITIVE LINK OPERATOR

Algorithms for traversing links in a work order justification knowledge representation provide a basis for access the data visualizing and analyzing the rational for a budgetary investment expressed in a justification instance. A transitive link operator (Kunii 1990, p. 18) can be defined to start at an object instance of a justification instance and recursively identify and navigate all semantic relationships to identify data records for object instances expressing the meaning of the justification.

Let o_i be an instance of a given justification object type O_i and r_i be an instance of a given justification relationship type R_i, then *All-related-objects(*o_i*)* can be defined as a transitive link operator that:

1. Set list of *related-objects* to null
2. Identify each relationship r_i in $\underline{R}$ that o_i is part of in either of the roles O_{j1} or O_{j2}, if r_i is null return *related-objects*
    a. Otherwise
        i. Traverse linkage of each relationship r_i connected to o_i
        - Append the associated o_{j2} or o_{j1} as instantiated in the justification by r_i to *related-objects*
        - Recursively apply 2 to the associated o_{j2} or o_{j1} as instantiated in the justification by r_i

PROPERTIES OF JUSTIFICATION OBJECTS

Each object structured within the work order justification knowledge representation may be stored in working memory of the parser and analytical processing application or persisted in the database along with its associated properties and values according to its type: i.e. Asset, Component, Issue, Impact, Symptom, Solution, Geographic Feature, Facility (Constructed Asset), Evaluation, Repair, Replacement, Improvement, Augmentation, Regulatory Compliance, Hydraulic Analysis, and Alternative Options.

Associated with O_i in $\underline{O}$ is an ordered list of properties P_i, $P_i = \{P_{i1}, P_{i2}, \ldots, P_{ik\ k=f(i)}\}$.

For example,

O_{Asset},A_{Asset} = (ObjectID, AssetType, Synonyms, Homonyms, AssetDatabase, AssetID, …)
$O_{Component}$,$A_{Component}$ = (ObjectID, ComponentType, Synonyms, Homonyms, ComponentDatabase, ComponentID, …)
O_{Issue},A_{Issue} = (ObjectID, IssueType, Synonyms, Homonyms, …)
$O_{Symptom}$,$A_{Symptom}$ = (ObjectID, AffectedArea, Observation, Synonyms, Homonyms, Details, Type, …)
O_{Impact},A_{Impact} = (ObjectID, ImpactType, Synonyms, Homonyms, ImpactRating, ImpactSource, Likelihood, LikelihoodSource, …)
…

Let p_{im} denote a value of P_{im}, then an instance p_i is a given justification object type P_i, which can be expressed as $p_i = (p_{i1}, p_{i2}, \ldots, p_{ik})$.

Combining these metadata with the semantic relationship links described above results in a metalevel representation of work order justifications. The representation can be used for an ontology information system: as an ontology for the parser, and as a knowledge representation for a semantic pattern detecting and visualization application for finding and explaining commonalities, and as a schema for an object-relational database to persist work order justifications.

Semantic network representation coupled with graph matching has been demonstrated as a solution for finding commonalities and differences in apparently disparate expressions of analytic reasoning (Lanter 1994). These techniques provide a basis for automatically comparing work order budget justifications, and provides a basis for determining equivalence, similarities and differences in their logic.

WORK ORDER JUSTIFICATION EQUIVALENCE

Data equivalence exists in any portions of two or more justifications that represent the same types and properties of objects structured within the same kinds of relationships.

The search for equivalence focuses on commonality among knowledge representations within two domains:

1. Properties of objects
2. Relationships between objects

Equivalence of justification object instances is based on their equivalent property values, which can be denoted:

$$o_{i'} \equiv o_{i''}$$

iff

$$\forall P_{ik} \in P_i \wedge p_{i'k} = p_{i''k}$$

Equivalence of relationship instances is based on equivalence of their objects in the object roles they play, which can be denoted:

$$r_{i'} \equiv r_{i''}$$

iff

$$\forall R_{jw} \in R_j \wedge o_{j,1'} \equiv o_{j,1''} \wedge o_{j,2'} \equiv o_{i,2''}$$

WORK ORDER JUSTIFICATION SIMILARITY

Determination of equivalence in justifications, however, can be confounded by conflicts in words used to label the concepts expressed in the objects. Such conflicts make it necessary to search for similarity in metadata representations of the different realities and differences in metadata representations of the same reality expressed by authors of work order justifications (Batini et al., 1992). For example, synonyms exist when the same issues, impacts or solutions are referred to by different names. Homonyms exist when the same name is used for different issues, impacts, or solutions. The use of standard issue, impact and solution classification schemes provides a theoretical basis for ensuring that such synonym and homonym conflicts do not occur when comparing justifications. One possible approach to matching synonyms and homonyms used between different justifications is the classification 'crosswalk'. For example, a classification crosswalk can be developed to enable matching similar categories of issues, impacts or solutions that may be found in issues, impacts, or solutions written by different justification authors.

Justification similarity exists in any portions of a set of justifications that represent similar types and properties of objects structured within the same kinds of relationships. Similarity of justification object instances is based on their similar property values, which can be denoted:

$$o_{i'} \approx o_{i''}$$

iff

$$\forall P_{ik} \in P_i \wedge p_{i'k} \approx p_{i''k}$$

Similarity of relationship instances is based on similarity of their objects in the object roles they play, which can be denoted:

$$r_{i'} \approx r_{i''}$$

iff

$$\forall R_{jw} \in R_j \wedge o_{j,1'} \approx o_{j,1''} \wedge o_{j,2'} \approx o_{i,2''}$$

ANALYSIS OF COVARIATION OF WORK ORDER JUSTIFICATIONS

The skeletal ontology and object-oriented schema described in this research provides a straightforward basis for supporting graphical query functions for analyzing and understanding commonalities and patterns in work order justifications. In addition to using schema navigation to traverse and evaluate objects matching across AND relationships of composite/component objects OR relationships of generalization/specialization objects can also be examined and matched for equivalence or similarity.

This kind of graph matching can start at any of the Issue, Impact, Solution, and Asset nodes of a set of justifications being compared. Examination of the resulting specializations of work order justification components can reveal insightful covariation of similarities and differences in otherwise disparate datasets. Queries from the following classes can be interactively concatenated in response to displays of available work order justification data to narrow down the desired justifications.

1. Display distribution of justifications across Assets and their properties
2. Display distribution of justifications across Components and their properties
3. Display distribution of justifications across Issues and their properties
4. Display distribution of justifications across Symptoms and their properties
5. Display distribution of justifications across Impacts and their properties
6. Display distribution of justifications across Solutions and their properties
7. Display distribution of justifications across Assets, Components, Symptoms, Impacts and Solutions and their properties

For example, justifications can be queried based on a property of a component object such as "type":

- A query on an **asset's type** will return work order justifications proposed for that type of asset and enable display, subsequent graph matching for equivalence/similarity determination, querying and analysis of the covariation of all:
  - Issues affecting that type of asset
  - Impacts resulting from issues affecting that type of asset
  - Symptoms of issues affecting that type of asset
  - Solutions for resolving the issues and resolving the conditions affecting that type of asset described in the justifications

- A query on an **issue type** will return work order justifications proposed for that type of issue, and enable display, subsequent graph matching for equivalence/similarity determination, querying and analysis of the covariation of all:
  - Assets with that type of issue
  - Symptoms of that type of issue
  - Impacts of that type of issue
  - Solutions to that type of issue
  - described in the justifications

- A query on a **symptom type** will return work order justifications proposed for that type of symptom, will enable display, subsequent graph matching, querying and analysis of the covariation of all:
  - Assets with that type of symptom
  - Issues associated with that type of symptom
  - Impacts associated with that type of symptom
  - Solutions that quell that type of symptom
  - described in the justifications

- A query on an **impact type** will return work order justifications proposed for that type of impact, and enable display, subsequent graph matching, querying and analysis of the covariation of all:
  - Assets associated with that type of impact
  - Issues that may result in that type of impact
  - Symptoms associated with that type of impact
  - Solutions that mitigate that type of impact
  - described in the justifications.

CONCLUSION

This paper described an approach for developing an ontology-based object-oriented processing application and database system able to learn how to parse and process work order justifications to detect and analyze patterns of commonality of their business cases. The stepwise construction of a global object-oriented work order justification ontology/data model was illustrated. Logic was provided for analyzing the semantic structure of work order justifications and automatically detecting commonalities necessary for comparative analysis.

Future implementation in a pilot project focused on Operations & Maintenance (O&M) work order budget justifications offers a way to evaluate the benefits of unified standard language and suite of intelligent tools for analyzing and increasing understanding of business cases for and asset management work orders.

REFERENCES

Batini, C., Ceri, S., & Navathe, S. B. (1992). *Conceptual database design an entity-relationship approach*. The Benjamin/Cummings Publishing Company, Inc.

Booch, G. (1991). *Object-oriented analysis with applications*. The Benjamin/Cummings Publishing Company.

Chen, P. (1976). The entity-relationship model - toward a unified view of data, *ACM Transactions on Database Systems*. *1*(1), 9–36.

Kunii, H. S. (1990). *Graph data model and its data language*. Springer-Verlag.

Lanter, D. P. (1994). Comparison of spatial analytic applications of GIS. In Editors: W. K. Michener, J. W. Brunt & S. G. Stafford (Eds.), *Environmental Information Management and Analysis: Ecosystem to Global Scales* (pp. 413-425). Taylor & Francis.

Nguyen, V. (2011). *Ontologies and information systems: A literature review*. DSTO-TN-1002, Defense Science and Technology Organization, Commonwealth of Australia.

Reul, Q. H. (2012). *Role of description logic reasoning in ontology matching*, [Unpublished Doctoral dissertation]. University of Aberdeen.

Rumbaugh, J., Blaha, M., Premerlani, W., Eddy, F., & Lorensen, W. (1991). *Object-oriented modeling and design.* Prentice-Hall, Inc.

Sinha, P. K., & Dutta, B. (2020) A systematic analysis of flood ontologies: A parametric approach, *Knowledge Organization*, *47*(20), 138-159.

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USING UTAUT FOR BLOCKCHAIN ASSESSMENT

Andrew Mangle, Bowie State University

ABSTRACT

With over 1000 public and private Blockchains (coinmarketcap.com, 2020), an acceptance model can facilitate an objective and comparative assessment of existing and future solutions. The paper outlines an assessment framework based on the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al. (2003)) using distinguishing characteristics of blockchain implementations: trust, utility, and support. Trust is one of blockchain's promises (Economist, 2015) and a paramount construct of decentralized autonomous software architecture. Utility is the functional attributes of the software architecture, while support is the nonfunctional attributes. Utility includes scalability and security that align with the UTAUT constructs *performance expectancy* and *effort expectancy*. Support includes governance and ecosystem that align with the UTAUT constructs *facilitating conditions* and *social influence*. The distinguishing characteristics of trust, utility, and support in the context of UTAUT are beneficial for comparing and evaluating the myriad of blockchain implementations. The research encourages the examination of existing and future solutions using UTAUT-focused attributes. The study has broader implications for blockchain solutions by providing contextual constructs necessary for use and adoption.

INTRODUCTION

"Blockchains are tamper-evident and tamper-resistant digital ledgers implemented in a distributed fashion (i.e., without a central repository) and usually exist without a central authority (i.e., a bank, company or government." Yaga et al. (p 1, 2018). In 2008, the combination of blockchain and other technologies started cryptocurrencies, with 2009 being the genesis block of Bitcoin (Nakamoto, 2008). Blockchain technology has four primary characteristics: a ledger containing a transactional history, security assurances about the network's integrity, transactions and contents, shared contents, and ledger distribution. The blockchain consists of two categories: permissionless and permissioned. Permissionless blockchains are accessible to anyone, while permissioned requires authorization via centralized or decentralized authority. A Blockchain network architecture includes hashes, transactions, ledgers, blocks, and links among blocks. The models for achieving consensus, a single model of truth, vary among solutions.

Evaluating blockchain solutions can be overwhelming. A myriad of options awaits enterprises seeking to leverage blockchain's capabilities. In addition to the number of choices, discerning amongst available Blockchains is complicated by similar naming conventions (Bitcoin, Bitcoin Cash, Bitcoin SV, First Bitcoin, ByteCoin), similar foundational code (Ethereum-based, Bitcoin-based, and ZCash-based), competing vendors (Amazon, IBM, Microsoft), and an ever-evolving software and supporting ecosystems. Blockchains are prototypical of systems theory with open and interactive environments resulting in continuous improvement and evolution. Objectively evaluating blockchain benefits is necessary and relies on understanding the core capabilities and distinctions among the available options. Iteration through existing solutions is an arduous task where conflicting, out-of-date, and potentially disingenuous information exists. Organizations have few resources to assess viable options. In 2017, Gartner indicated that blockchain had reached the hype cycle's peak, which includes inflated expectations (Panetta, 2017). The paper seeks to clarify the evaluation and assessment of blockchains based on the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003).

UTAUT identifies four primary independent constructs (performance expectancy, effort expectancy, social influence, and facilitating conditions) that impact behavioral intention and use behavior. The paper classifies blockchain attributes to the UTAUT independent constructions that affect acceptance – perceived usefulness and ease of use. The blockchain attributes include trust, utility and architecture, and support. Utility and architecture are the functional attributes of the blockchain, while support is the nonfunctional attributes. The functional attributes are associated with performance and effort expectancy the nonfunctional attributes are associated with facilitating conditions and social influence. Matching specific attributes to acceptance will help businesses evaluate blockchains as well as assist future blockchain development.

The paper consists of several sections. Section 2 provides a literature review of blockchain attributes and UTAUT. Section 3 offers the research approach and methodology. Section 4 provides a summary, implication, limitations, and future research.

LITERATURE SURVEY

Blockchains emerge, evolve, and fork over time. Bitcoin (Nakamoto, 2008) and Ethereum (Buterin, 2013) demonstrate blockchains' dynamic nature. The capabilities and unique distinctions of blockchain have become a source of interest for enterprises. Multiple taxonomies to classify and explain the fundamentals of blockchain are available in the literature (Tasca and Tessone (2017), Xu et al. (20017), Yaga, et al. (2018). The taxonomies offer definitions, including common architecture and core terms, to compare blockchain implementations. The taxonomies serve as a foundation for further research into the technology but not for assessment. Subsequent study has compared various Blockchains and their attributes (Valenta and Sandner, 2017; Pongnumkul et al., 2017). Emerging research has provided an opportunity to leverage the taxonomies and preliminary blockchain analysis to propose an assessment framework. Based on the available literature, the study offers a method of evaluation using the taxonomies, analysis, and Information Systems theory. The literature demands research into blockchain platforms to aid the measurement and assessment of value for the industry. Risius and Sphrer (2017) state, "Regrettably, very little research has empirically investigated the strategies and tactics applied by companies or industries when working on a new blockchain solutions or action on existing blockchains" (pg. 399).

Several articles have attempted to assess the value of Blockchain technology. Carson et al. (2018) identified the value in low-trust environments, immutability, dependence on security infrastructure, and truth determination. The blockchain value supports the authors' categories of Use Cases – static registry, identity, smart contracts, dynamic registry, payment infrastructure, and other (ICO's and Blockchain as a Service). Mulligan et al. (2018) provided a decision tree tool for the rapid analysis of blockchain as an appropriate solution for maximum value. The International Standards Organization (ISO) has formed a working group ISO/TC 307 on Blockchain and Distributed Ledger Technologies. Each highlights the recognition of new business models, implementations, and implications of blockchain noted by Beck et al. (2017), but not on the assessment from perceived usefulness and ease of use.

In the articles and working groups, methods to identify and direct opportunities for using blockchain are identified but fail to guide how to assess a blockchain solution for technology acceptance. For a firm looking at a possible Blockchain implementation, multiple options exist. The challenge for a Blockchain implementation is the evaluation of the offerings. Even if a company addresses the blockchain trilemma of correctness, decentralization, and cost efficiency (Abadi and Brunermeir, 2019), which two should a firm value most, and how will the third be mitigated? The literature survey reveals a gap in comparing and assessing Blockchain frameworks based on identified challenges and problems.

Zheng et al. (2016) summarized the challenges facing blockchain into broad groups – scalability, privacy, and selfish mining. Scalability includes the size of the blockchain, size of transactions, and the number of transactions per second. Bitcoin is inherently restrictive based on the software's design, including block timing and size restrictions, which result in a code fork to accommodate larger and faster transactions (Bitcoin Cash). Forks are alternative code bases that diverge from the source. Additional strategies for scalability include off-chain or sidechain tied to the main chain but are not directly connected as in a single stored hash of a block of transactions. The paper proposes these modifications were made to support technology acceptance.

The identified gaps in the literature include developing an assessment beneficial for all stakeholders, including both the supply (creators) and demand (users) side of blockchain. The approach is use-case agnostic compared to other research focusing on Use Cases and applicability (Gatteschi et al., 2018). Queiroz and Wamba (2019) also proposed using UTAUT for blockchain adoption; however, their research focus was limited to the supply chain in India and the USA. Another gap is providing an assessment approach for a moving target. Adopting UTAUT as the assessment model, stakeholders can create baselines and metrics to assess the technology acceptance constructs.

RESEARCH APPROACH AND METHODOLOGY

The research approach utilizes existing blockchain taxonomies, preliminary evaluation of UTAUT for blockchain, and align both in a flexible and practical assessment model. The primary task was to identify the attributes of blockchain. Next, blockchain attributes were mapped into functional requirements, nonfunctional requirements, and trust. Early research, outlined by Mangle (2019), assessed blockchain into Utility and Support constructs. However, trust was omitted in the analysis, and the study was not grounded in acceptance theory. Trust impacts the four primary

constructs of UTAUT and is also supported by Queiroz and Wmaba (2018). UTAUT provides a framework for guiding blockchain assessment, and this section sets out to show readers on UTAUT for Blockchain Assessment.

A literature survey identified five unique factors for qualitative and quantitative assessment of scalability, security, governance, ecosystem, and trust as significant factors in assessing Blockchain options. The taxonomies presented by Tasca & Tessone (2017) and Xu et al. (2017) interweave these factors through their models. An initial attempt is made through a literature review to align the five factors and attributes within the UTAUT framework.

Table 1 - Blockchain Attributes and UTAUT Framework

<table>
<tr><td colspan="4">Trust</td></tr>
<tr><td colspan="2">Performance Expectancy and
Effort Expectancy</td><td>Facilitating Conditions</td><td>Social Influence</td></tr>
<tr><td colspan="2">Utility/Architecture (Functional)</td><td colspan="2">Support (Nonfunctional)</td></tr>
<tr><td>Scalability</td><td>Security</td><td>Governance</td><td>Support</td></tr>
</table>

Trust

As part of a sharing economy, trust is different in the blockchain context. Instead of a vast network of interconnected and multi-dimensional market participants, blockchain is a trust-less technology that acts as a third-party intermediary (Hawlitschek et al., 2018). The blockchain serves as a trustworthy recordkeeper provided a ledger of immutable records (Lemieux, 2017). Trust in the software is paramount. Blockchain's foundation is trust in the system to maintain integrity. In theory, a blockchain should defend against nefarious actors that seek to undermine the authenticity of the ledger. Since blockchain is a trustless-software architecture, a violation of trust is a security violation. The functional and nonfunctional blockchain attributes are dependent upon the infrastructure to maintain trust for acceptance and use.

Scalability

The attributes of scalability align and overlaps with two UTAUT constructs; performance and effort expectancy. There is an overlap between obtaining gains and ease of use associated with the system from the blockchain's scalability construct. Scalability is part of the functional attributes of blockchain that fall under utility and architecture. Scalability includes infrastructure and capabilities. Infrastructure is the ability to manage transactions. Transactions have a content size (kilobytes), quantity (number), speed (per second), and composition. Capabilities are the features to support trust, governance, infrastructure, security, and ecosystem. Capabilities can include executing smart contracts, managing off-chain or sidechain, supporting consensus, protecting anonymity, and distinct attributes that offer differentiation among blockchain solutions.

Security

The attributes of security also algin and overlap with two UTAUT constructs; performance effort expectancy. Security requires a balance between usability. Increases in security usually impede usability. Security is part of the functional attributes of utility and architecture. Security includes the selected algorithm(s) and approach(es) for account creation and consensus. The security factor supports other factors. Security for this model includes privacy. Blockchain solutions can offer both unshielded (public) and shielded (private) addresses. In the case of a Bitcoin unshielded address, the transactions can be used to identify the owner (Barcelo, 2014). Security also includes the ability to protect against various Blockchain attacks, including Sybil, Routing, Direct DoS, 51% attacks, cryptographic vulnerabilities, and coding errors (Risberg, 2018). Additional security concerns include underlying cryptographic algorithms, including PKI, which may be susceptible to future vulnerabilities, including quantum computing (Sata and Matsuo, 2017). Decentralization is a paradigm that assures no single entity or location can manage the blockchain; however, this is not a requirement. Decentralization is an attribute in security that could also be discussed in the next section governance.

Governance

The attributes of governance align with the UTAUT construct facilitating conditions. Facilitating conditions include both the technical and organizational infrastructure to support the technology. Governance is a nonfunctional attribute that helps the blockchain. In blockchain, decision-making occurs automatically through the software, but who controls automation and the supporting software are the decision-makers. In an open-source model, all entities can view and edit source in a common repository. However, in most blockchains, including Ethereum, Bitcoin, and PIRL, decisions are guided by the community while a core leadership team makes the final decisions and implements the updates. In consensus-based blockchain models, the participants have the opportunity to 'fork' or divert from the chain by adopting (or not) revisions to the blockchain source code. Consensus is the method for determining the version of 'truth' on the blockchain. Consensus algorithms include Proof of Work (mining), Proof of Stake, Proof of Activity, Proof of Burn, Proof of Capacity, and Proof of time, with each providing distinct features. The consensus algorithms include different oversight mechanisms that impact the leadership structure and incentives for Blockchain support. Blockchain requires maintenance and review. Two standard public Blockchains, Bitcoin and Ethereum, have gone through many protocol revisions. Ethereum plans to shift away from Proof of Work to Proof of Stake through a transitionary hybrid approach (Buterin, 2018). Blockchains evolve, and governance supports the use and growth of the system.

Support

The attributes of governance align with the UTAUT construct social influence. Social influence includes technology as well as the supporting ecosystem. Support is a nonfunctional attribute of blockchain. The support attributes include social media, technical support, tools, markets, stakeholders (analysts), and culture. Social media consists of the quality and quality of the followers, contributes, and networks. The networks include traditional social networks (Facebook, Twitter, Reddit) and team chat platforms that offer access to the governing team (Discord, Slack, Telegram). Technical support in a decentralized platform can be delegated to the social networks or traditional customer service platforms such as Zendesk that allow global 24/7/365 access. The ecosystem includes the tools to support onboarding, transactions, and facilitation of participation with the software. One form of participation in markets that allow the exchange of fiat or cryptocurrency to use the software. The markets and mining offer a gateway to using some blockchains and outside stakeholders to evaluate the community's assessment of value.

Blockchain is a pay-per-state-change. The cost can be standardized using a single fiat currency across a period of time based on market variability and standardized transaction size for storage. Storage costs can be measured both as on-chain and off-chain. Cost also includes the time to execute the transaction. Costs, including mining fees, will be normalized as they are variable based on the network's transaction activity and market fluctuations. The markets determine the costs. The software, governance, markets, and support make up core aspects of the culture of the blockchain, which guides cooperation and collaboration. The blockchain's culture is a culmination of the ecosystem.

SUMMARY

To achieve widespread adoption, users must accept the technology. Blockchain development, including architecture, governance, and ecosystem, should be evaluated using UTAUT. The research focus of blockchain and user acceptance, including identifying use cases, suggests acceptance will occur shortly after implementation. The model of 'if you build the use case, people will come' is littered with failed blockchain efforts. Alone, Blockchain Technology cannot meet all the UTAUT constructs. A survey should be developed for companies currently using or considering the adoption of blockchain to assess the significance of UTAUT factors and potentially identify specific factors related to blockchain that may exist. Future research should also examine the gaps between technology and a support structure (governance, ecosystem, trust).

REFERENCES

Abadi, J., & Brunnermeier, M. (2018). Blockchain economics (No. w25407), *National Bureau of Economic Research*, DOI 10.3386/w25407.

Barcelo, J. (2014). User privacy in the public bitcoin blockchain. URL: http://www.dtic.upf.edu/~jbarcelo/papers/20140704_User_Privacy_in_the_Public_Bitcoin_Blockchain/paper. pdf (Accessed 09/05/2016).

Beck, R., Avital, M., Rossi, M., & Thatcher, J. B. (2017). *Blockchain technology in business and information systems research*: Springer.

Buterin, V. (2013). Ethereum white paper. (2013). URL https://github. com/ethereum/wiki/wiki/White-Paper.

Buterin, V. (2018). Casper version 2.1 Implementation guide. Retrieved from https://github.com/ethereum/research/wiki/Casper-Version-2.1-Implementation-Guide

Campbell, R. (2020). The need for cyber resilient enterprise distributed ledger risk management framework. *The Journal of The British Blockchain Association, 12257.*

Carson, B., Romanelli, G., Walsh, P., & Zhumaev, A. (2018). Blockchain beyond the hype: What is the strategic business value? *McKinsey Digital*.

Castillo, M. d. (2019). Blockchain's billion dollar babies. Forbes. Retrieved from https://www.forbes.com/sites/michaeldelcastillo/2019/04/16/blockchains-billion-dollar-babies/

Economist, T. (2015). The promise of the blockchain: The trust machine. *The Economist*, *31*, 27.

Gatteschi, V., Lamberti, F., Demartini, C., Pranteda, C., & Santamaría, V. (2018). Blockchain and smart contracts for insurance: Is the technology mature enough? Future Internet, *10*(2), 20.

Hawlitschek, F., et al. (2018). The limits of trust-free systems: A literature review on blockchain technology and trust in the sharing economy. *Electronic Commerce Research and Applications 29*, 50-63.

Lemieux, V. L. (2017). Blockchain and distributed ledgers as trusted recordkeeping systems. Paper presented at the Future Technologies Conference (FTC).

Mulligan, C., Scott, J. Z., Warren, S., & Rangaswami, J. (2018). Blockchain beyond the hype: A practical framework for business leaders. Paper presented as a white paper of the World Economic Forum.

Pongnumkul, S., Siripanpornchana, C., & Thajchayapong, S. (2017). Performance analysis of private blockchain platforms in varying workloads. Paper presented at the 2017 26th International Conference on Computer Communication and Networks (ICCCN).

Queiroz, M. M. and S. F. Wamba (2019). Blockchain adoption challenges in supply chain: An empirical investigation of the main drivers in India and the USA. *International Journal of Information Management 46*, 70-82.

Risberg, J. (2018). Yes, The blockchain can be hacked. Retrieved from https://coincentral.com/blockchain-hacks/

Risius, M., & Spohrer, K. (2017). A blockchain research framework. *Business & Information Systems Engineering*, *59*(6), 385-409.

Sato, M., & Matsuo, S. i. (2017). Long-term public blockchain: Resilience against compromise of underlying cryptography. Paper presented at the 2017 26th International Conference on Computer Communication and Networks (ICCCN).

Shen, M. (2020). Crypto investors have ignored three straight 51% attacks on ETC. Retrieved October 3, 2020, 2020, from https://www.coindesk.com/crypto-51-attacks-etc.

Tasca, P., & Tessone, C. J. (2017). Taxonomy of blockchain technologies. Principles of identification and classification. *arXiv preprint arXiv:1708.04872*.

Valenta, M., & Sandner, P. (2017). Comparison of ethereum, hyperledger fabric and cord. *June*, 1-8.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS quarterly*, 425-478.

Tasca, P., & Tessone, C. J. (2017). Taxonomy of blockchain technologies. Principles of identification and classification. arXiv preprint arXiv:1708.04872.

Valenta, M., & Sandner, P. (2017). Comparison of Ethereum, Hyperledger Fabric and Corda. [ebook] Frankfurt School, Blockchain Center.

Xu, X., Weber, I., Staples, M., Zhu, L., Bosch, J., Bass, L., & Rimba, P. (2017). A taxonomy of blockchain-based systems for architecture design. Paper presented at the 2017 IEEE International Conference on Software Architecture (ICSA).

Yaga, D., Mell, P., Roby, N., & Scarfone, K. (2018). NISTIR 8202 Blockchain Technology Overview. Retrieved from National Institute of Standards and Technology, US Department of Commerce.

Zheng, Z., Xie, S., Dai, H.-N., & Wang, H. (2016). Blockchain challenges and opportunities: A survey. WP 2016.

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ESSENTIAL FACTORS THAT INFLUENCE CORPORATIONS TO OUTSOURCE TO SUB-SAHARAN AFRICA: A FOLLOW-UP CASE ANALYSIS OF MBE CORPORATION

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ABSTRACT

Outsourcing is a powerful way for organizations to enhance service, save money, and focus on core competencies while helping develop a cost-effective global chain that meets the increasing needs of customers regarding cost, flexibility, and responsiveness. Companies initiating outsourcing collaborations must decide not only between insourcing versus outsourcing and near shoring versus far shoring; leaders must consider the scope of global projects. The purpose of this qualitative research was to conduct a follow-up with a case study that was conducted on a consumer electronics service company located in the Northern United States under the pseudonym company name Megan Bay Enterprise (MBE) Corporation. In this case analysis the decision makers wanted to track the effects, if any, of the initial case analysis and weigh out MBE's stand on the 2013 case analysis that had outlined benefits of opting to outsource to Sub-Saharan Africa (see Appendix A) instead of using in-house workforce to perform their core competency of customer service tasks. The participant sample was consistent with the 2013 case analysis and contained a purposeful sample of 20 MBE employees that had the same range of 1 to 15 years of working experience. The same 2013 questionnaire was applied when interviewing the managers at MBE Corporation. The present findings from the 2015 case analysis were undeviating from the first study and confirmed the following themes (a) gaining benefits such as opportunities to improve performance, (b) increase efficiency, (c) lower costs, and (d) increasing focus on core competencies. The proposed results could contribute to the organizational leaders understanding of the advantages of outsourcing by corporations that are relentless in using in-house workforce and cynical about using experienced outsourcing workforces for their services.

INTRODUCTION

Bouchet (2010) and Schoenherr (2010) mentioned that outsourcing goods and services is pervasive in the United States economy and classifies as the inevitable for most companies in a competitive marketplace. Adegbie and Adeniji (2011) and Benito, Dovgan, Petersen and Welch (2012) studies mention that outsourcing consists of global or domestic subcontractors for goods and services production. As the gaps between what client companies want to accomplish and what companies can do in-house continue to increase, Aktas, Agaran, Ulengin and Onsel (2011) confirmed that the justification for outsourcing to third-party providers receives further validation. Research conducted by Pouder, Cantrell, and Daly (2011) confirmed 82% of medium-sized and large firms in North America, Asia, and Europe used outsourcing to accomplish part of or all daily work activities. In comparison, McDonald (2010) confirmed that over 80% of organizations outsource, and outsourcing managers confirmed a 90% increase in outsourcing.

The outsourcing markets have been experiencing the largest number of outsourcing projects since data collection began. The three largest sectors as mentioned by Tambe and Hitt (2010) and Walls (2010) receiving the most outsourcing projects in 2009 were business services, communication, and software and information technology (IT) services. The three sectors have been the most outsourced sectors for the past seven years, with financial services experiencing high levels of outsourcing growth. Anderson (2010) stated that the machinery and equipment sector witnessed a similar rise in outsourcing, and Hewlett-Packard and IBM topped the charts with totals of 55 and 52 outsourced projects from 2003. In comparison, Kocaga's (2010) research confirmed that the worldwide market for customer service outsourcing grew from approximately U.S. $58 billion in 2006 to U.S. $92 billion in 2010. Mexico has been the regional leader according to A.T. Kearney Global Services Location Index (GSLI), which ranks outsourcing and call center competitiveness. Mexico ranked number six up from 11th place in 2009 as reported in a 2011 survey of 50 countries worldwide. Holley (2011) confirms that Mexico's proximity to the United States results in the number of dual-language call centers and an 18% drop in Mexican wage earnings.

The worldwide outsourcing market as mentioned by Yang (2010) grew from U.S. $161.9 billion in 2002 to more than U.S. $235.6 billion in 2007 at a compound growth rate of 7.8%. For example, Speter's (2011) study confirmed that outsourcing and globalization made China the second largest economy in the world. Chen, Tian, Ellinger and Daugherty (2010) mentioned that the Chinese market more than doubled the 1999 revenue of US $55.8 billion and was expected to reach U.S. $120.8 billion by 2010. The rapid growth of international service outsourcing in China as confirmed by Dollatabady and Forghani (2011) and Tate and Ellram (2012) caused constant expansion of the market and 3.3 million American IT jobs moving overseas by 2015.

LITERATURE REVIEW

The capacity of the literature review in this segment included existing research of peer-reviewed publications by Oliveira, Hartung and Wendling (2010) that offer supporting verification of the influencing factors that magnetize corporations to pursue outsourcing. The fields of outsourcing evoked interest in the 1950s. Dube and Kaplan (2010) and Zi (2011) mentioned that the term outsourcing was coined in 1979, and outsourcing of services grew during the 1980s. Global service outsourcing to low-cost countries as mentioned by Sinha, Akoorie, Ding and Wu (2011) had been on the rise during the period between the 1980s and 1990s when organizations saw outsourcing as a panacea for tackling rising costs, poor performance, and lack of skilled professionals. In a study to determine the firms' value of outsourcing, Pouder et al. (2011) found 82% of medium-sized and large firms in North America, Asia, and Europe used outsourcing to accomplish part of or all daily work activities. In comparison, McDonald (2010) confirmed that over 80% of organizations outsource and outsourcing managers confirmed a 90% increase in outsourcing. Additionally, survey results by Dollatabady and Forghani (2011) of 52 different types of companies in Europe and United States indicated that 79% of outsourcing was moving helpdesk jobs to international providers. Pouder et al. (2011) confirmed that outsourced activity was at 41% in IT, 19.3% in manufacturing, 7.0% in logistics, and 5.3% in facilities management. The findings by Pouder et al. (2011) also revealed outsourcing to consist of 4.1% in equipment maintenance, 4.1% in customer service, and 2.9% in human resources; 2.3% in finance and accounting, 1.8% in sales and marketing, 1.8% in management, 1.8% in printing, and 0.6% in purchasing.

Firms that outsource as mentioned by Whitaker, Mithas, and Krishnan (2010) and Zirpoli and Becker (2011) note that part of the business process takes into consideration the suppliers' strategic incentive regarding subcontracting. Gandhi (2011) and Monaghan (2011) confirmed that outsourcing was a major challenge that the management team at Boeing airlines faced. An example of ineffective risk management in an outsourcing project came in the production of Boeing 787. The goal of the management team as mentioned by Gandhi (2011) that Boeing was to build the 787 aircraft. The Boeing leaders abandoned the normal practice of designing and building in-house for outsourcing production to vendors around the world. Boeing leaders admitted that the outsourcing system had major flaws that included quality control of unfinished components in Seattle. Leaders at Boeing's move to outsource work on the 787 led to problems. Gandhi (2011) mentioned that the concerns contributed to the company posting a U.S. $1.5 billion loss for the third quarter of 2009. In comparison, risk management is a factor crucial for the growth of outsourcing, and risk management causes challenges for a business planning an offshore capability. Desai and McGee (2010) and He et al. (2011) confirmed that risk management is important for global companies moving operations offshore to guarantee that the process is equipped even in the event of a disaster.

Evidently, Pouder et al. (2011) confirm that firms equate the cost of outsourcing to the cost of hiring additional resources to do the work internally. Firms look at the overall picture as mentioned by Kshetri and Dholakia (2011) that show they are able to negotiate better deals and save on capital expenditure. For example, Pouder et al. (2011) confirmed that Unilever outsourced its data network to IBM Business Consulting Services. The 7-year contract was to cut the overhead cost and increase efficiency in the short run. Pouder et al. (2011) mentioned that outsourcing objective was to enhance product development in the end. Unilever expected annual cost savings of approximately $840 million. Pouder et al. (2011) confirmed that Kodak's anticipation of immediate cost reduction and the outsourcing of certain components in digital camera manufacturing could create a long-term gain in market share.

METHOD

The failure of outsourcing ventures exists through major threats as confirmed by Niranjan and Rao (2011) from leadership and commitment to organizational issues such as structure, culture, and decision-making infrastructure. The domestic and offshore decision makers' understanding of the priorities and key outsourcing issues is vital to the development of relevant decision-making strategies. This research study was limited to a qualitative single-case study design bounded to the consumer service organization located in Northern Pennsylvania in the United States; the pseudonym for the company name used in this case study was MBE Corporation. The case study organization using the pseudonym MBE has core competencies that include innovation of consumer electronics in the mobile, television, and appliances for both domestic (USA) and international markets while also providing customer service to their respective consumers. MBE organization, with its location in a developed country, was valued at $518 million in 2015 with over twenty thousand employees within their single location in the USA. The case study design on the MBE organization was an approach that the researcher used because in a similar study Merriam (2010) used case studies to facilitate exploration of a phenomenon within its real-life context. An important dimension of the follow-

up case analysis was to obtain data from MBE Corporation's managers to determine the effect of the 2013 analysis (as shown in Appendix A) of the factors that could influence their decision to outsource their customer service tasks. This research focused on the case study on the MBE organizations whose core competencies of innovation and customer service were being analyzed to determine if outsourcing one of their core competencies would hinder or help the organization. The investigation approach was placed on conducting interviews with MBE decision makers that were reluctant to take on outsourcing in the 2013 analysis. MBE's decision maker's unwillingness to outsource had a connection to existing peer research by Ravindran (2010) that documented Deloitte Consulting outsourcing services whereby 50% of the outsourced arrangements failed.

The focal point of the research was to follow-up with MBE decision makers and provide my academic analysis of the differences or similarities between the 2015 and 2013 analysis (as shown in Appendix A) of the essential factors that the MBE Corporation would benefit from if they outsourced their customer service department. In simple terms, this follow-up case analysis was to determine if the benefits of conducting customer service using an in-house workforce outweighed the benefits of outsourcing to third-party specialized companies. The selection of formal face-to-face interviews was related to research done by Hajebi et al. (2012) as the preferred method of interaction for data collection. Data collection from varied years of experience allowed for contrast and comparison of the MBE managers. The selection of the participants' sample, data collection, data organization, coding, analysis, and identification of themes are as follows.

PARTICIPANTS

Selection of sample size relied on previous research done by Boeije (2010) who used a purposeful sampling strategy to research. The sample size of 20 participants from the MBE population for this follow-up case study was purposefully selected and consisted of MBE personnel with a range of one to fifteen years of work experience. The purposeful sample selection was to capture a variation in working experience for the objective of data comparison and providing clarity of the skepticism of outsourcing as we explored if indeed outsourcing was beneficial for their corporation. The participants willing to be part of the case study received consent forms that were signed, and face-to-face interviews were scheduled at participants' convenience. Confidentiality was the main objective emphasized and practiced by use of codes to distinguish the sample participants. The coding followed this simple process of capturing each participant MBE1, MBE2, MBE3, …MBE20; and MBE1.1 for 1-year experience, MBE2.2 for two years' experience etc. to capture years of working experience. This case analysis was to share with MBE decision makers that the benefits of conducting customer service in-house outweighed those of outsourcing the services to third-party companies.

PROCEDURE

This follow-up research was limited to MBE Corporation and my desire to identify any similarities or differences from 2013 to the 2015 analysis (see Appendix A) of MBE decision makers to tackle the potential essential advantages of outsourcing as an alternative of using an in-house workforce to conduct customer service tasks. The selection of the exploratory single-case study resulted from a study by Easton (2010) and Lindlof and Taylor (2010) that confirmed the need to explore those situations that had no clear, single set of outcomes. Peer research Cook (2010) used a single-case design to explore the effects of outsourcing in-service education and collected data from five teachers in Canada using oral interviews, observations, and questionnaires. In my single-case exploratory study, we collected data from 20 purposefully selected participants with one to fifteen years of working experience. The data were collected by the use of six open-ended interview questions that were designed by reviewing existing peer researcher's scholarly work on benefits of outsourcing. To identify the correlation of previous peer research to my existing research on benefits of outsourcing would help a skeptical company like MBE on cutting overhead cost and using outsourcing resources. To accomplish the research objective face-to-face interviews were conducted at the MBE facility, collected data was coded, and NVivo 10 software was essential in the identification of research themes. The coding of participants as MBE1, MBE2, to MBE20 and years of experience as MBE1.1, MBE2.2, to MBE20.15 was essential in comparing and contrasting the collected data to identify if indeed the benefits of conducting customer service using an in-house workforce outweighed the benefits of outsourcing to third-party specialized companies.

RESEARCH FINDINGS

The purpose of this follow-up case analysis was to determine if the benefits of conducting customer service using an in-house workforce outweighed the benefits of outsourcing to third-party specialized companies. The explicit themes from 2015 data analysis were like the 2013 themes (see Appendix A). The 2013 themes included (a) improve performance; (b) cost reduction and innovation; (c) firm can gain efficiencies; and (d) competitive advantage by enforcing cost reductions. The 2015 themes included (a) gaining benefits such as opportunities to improve performance - MBE would outsource to gain access to skilled labor in customer service; (b) increase efficiency - MBE would benefit by the opportunity of utilizing an outsourcing firm expertise to handle consumer relations; (c) lower costs - MBE would omit the need to hire, provide training, and maintain experienced workforce in customer service; and (d) increasing focus on core competencies. To clear MBE skepticism about outsourcing, we emphasized to the MBE decision makers that benefits of outsourcing outlined in the 2013 analysis were a replicate of the 2015 analysis. In simple terms, MBE decision makers were presented with the research findings confirming how the benefits of outsourcing to third-party specialized companies outweighed the benefits of conducting customer service using in-house workforce. MBE decisions makers were also advised of the advantage of outsourcing customer service and redirecting resources to their core competencies and achieving competitive edge in the market. The case study findings were directly linked to existing peer researcher's findings as elucidated below.

FACTORS THAT INFLUENCE FIRMS DECISION TO OUTSOURCE

Opportunities to Improve Performance

Participants' feedback confirmed that there existed a high turnover of the customer service workforce and the existing workforce lacked the essential skills to effectively handle customer support. In my analysis of the data and presenting the results to MBE, we emphasized that although outsourcing would provide access to improve performance while utilizing the specific skilled labor, the outsourcing leaders would have to consider the options between near shoring and far shoring. Company leaders expand their use of outsourcing for services and products in light of the Gunasekaran and Irani (2010) research that confirmed outsourcing as a viable pathway to improve a firm's performance. The objective was for MBE to understand that instead of seeking the opportunities to improve performance, MBE should keep in mind the importance of evaluating the benefits of opting to outsource one of their core competencies and focus on innovation of quality products factors. Outsourcing could help prevent situations documented in the findings of Desai and McGee (2010) of General Motors where 1.3 million cars were recalled because of a strike from the vendor. Similarly, Holbrook's (2011) findings confirmed that outsourcing operational risks are a byproduct of the complexity of operations, geographic separation, a cultural gap, the limits of communication, and/or transmission systems between the client company wanting to outsource and the third-party outsourcing firm.

Increase Efficiency

Participants MBES04, MBES10, MBES13 and MBES17 shared that "the ability to acquire up-to-date technology was a challenge thus lacked access to analytical computer systems to capture consumer data and assist in monitoring of trends." My study findings confirmed that the benefits of conducting customer service by using outsourcing to third-party specialized companies outweighed the current in-house workforce and the MBE organization would utilize the resources to focus on other core competencies that include innovation of their mobile, television, and appliance products. Using the findings as evidence, my discussion with MBE decision makers entailed recommendation like Rahman (2011) that they should take advantage of the specialized customer service capabilities offered by third-party outsourcing facilities that include access and usage of sophisticated technology. Mowla (2012) confirmed that outsourcing decision makers of corporations in North America and Europe pursue outsourcing initiatives to improve efficiency. The success of outsourcing intervention as confirmed by Hunter and Hall (2011) helps determine the nature of the interplay between the contracting organization and the third-party service provider. We urged MBE decision makers to follow Cordella and Willcocks (2010) and Susarla (2012) research that companies should monitor their selected third-party firms to minimize the possibility of premature termination of their outsourcing contracts because of ineffective project management and inflexible contracts. My objective was for MBE to understand that in similar research done by Jain (2012), the increase of efficiency would consist of MBE taking precaution in the selection of outsourcing vendors, checking on progress, and maintaining relationships thus leading to fewer outsourcing failures.

Lower Costs

The participant follow-up study findings contained similar viewpoints as the 2013 study (see Appendix A) confirming that MBE Corporation could lower the costs associated with having their internal workforce conduct customer service instead of outsourcing to third-party companies. Research by Contractor, Kumar, Kundu and Pedersen (2010) confirmed that companies that outsource benefit from reduction in costs when they form alliances with overseas companies to perform tasks on their behalf and provide the corporations with the ability to utilize outsourcing firm's innovation processes that are already set in place. To share evidence of cost reduction where corporations opted to utilize specialized outsourcing firms and access to the firm's innovative processes, participant feedback was compared to existing research. The research by Niranjan and Rao (201) confirmed that Companies such as Cisco Systems and Dell, that are in high technology, outsource much of product design to specialized companies. The companies maintain control over the final assembly, test, and customization of the product to customer requirement. For example, research by McIvor (2010) on Dell strongly suggests that these activities have little value to the end user. Another example is that some carmakers such as BMW and Volkswagen are pursuing similar strategies in the use of modular production (McIvor, 2010).

Increasing Focus on Core Competencies

Henderson (2011) confirmed that outsourcing is a powerful way for organizational leaders to focus on core competencies. Participants MBES14 and MBES17 shared that "MBE wanted to spend resources to focus on what was core thus be able to remain competitive in the market." Participant emphasis was that outsourcing could generate needed cash if MBE could sell assets or transfer customer relations workforce to an outsourcing firm. Participant MBES3 and MBES12 shared that "MBE would benefit from cost savings associated with outsourcing customer relations thus utilizing the funds in the investment of core competencies." Using the existing research done by Pouder et al. (2011), the speculation of cost advantage benefit by corporations is reliable because the third-party outsourcing services are proficient and offer efficient services using technology and workforce specialized in handling consumer demands than the corporations that desire to outsource. Research conducted by Mosher and Mainquist (2011) supported my emphasis to MBE that their outsourcing decision makers should verify applicable benefits when making decisions related to outsourcing. In addition, Niranjan and Rao (2011) had supportive evidence that we used to advise MBE that quality may improve through outsourcing; and the reality includes factors such as lack of visibility into and control over the vendor process that makes outsourcing to a third-party a riskier quality proposition. In contrast, Aktas et al. (2011) confirmed that research on outsourcing shows the client may also lose control and flexibility, which can risk disclosure of proprietary knowledge of potentially competing firms. Mosher and Mainquist (2011) confirmed that the client's reputation may suffer when a problem occurs because the client, not the vendor, bears responsibility no matter where the problem lies.

DISCUSSION WITH MBE DECISION MAKERS

The discussion of the research findings of the 2015 analysis in comparison with the 2013 analysis (see Appendix A) with the MBE decision makers was held at the MBE office location as they pondered on the benefits and the action plans to take on opting to outsource instead of using in-house employees to perform the customer service tasks. In the 2013 analysis the MBE's decision makers expressed that their attraction and desire to outsource was elicited by the evidence presented in my academic research. The 2013 analysis of findings were evident in the 2015 analysis whereby the academic advice offered to MBE entailed the firms' exploration of outsourcing options and existing peers conducted research. Prior to outsourcing, firms should finalize candidate lists, gather contact information, create a list of questions, set up interviews, phone, and the web or in person, and follow-up with outsourcing firms. Klingenberg and Boksma (2010) mentioned that choosing a provider should include philosophical alignment, chemistry, flexibility, costs, transition, period, complexity, and exit plans. In this research, my objective was to emphasize the importance of efficiency in performance to MBE Corporation; we shared the findings from the outsourcing material handling study to maximize operational performance, which proposed four operational performance criteria of cost, delivery speed and reliability, flexibility, and quality. This research study's aim was to help managers and engineers in structuring and deciding upon options for outsourcing material handling. The findings were that if the activities are carried off-site, delivery reliability is assured by outsourcing activities upstream of the customer order decoupling point (CODP). The CODP and Post- CODP activities need considering for outsourcing when the location of the activities is at the equipment manufacturer.

To bring clarity to the choice of domestic versus offshore outsourcing, the following was shared with MBE outsourcing decision managers. An analysis that had occurred on firm-level characteristics to facilitate onshore and offshore business process outsourcing. Whitaker et al. (2010) mentioned that the utilization of the organizational learning and capabilities occurs to assist in defining the managerial and technical capabilities that facilitate onshore and offshore business process outsourcing. Consistent with organizational learning theory, the findings confirm firms engaged in IT outsourcing with an established and mature management practice than business process outsourcing, are more likely to engage in onshore and offshore business process outsourcing. Whitaker et al. (2010) analysis confirmed that the firms with international experience are more likely to engage in offshore business process outsourcing.

To effectively handle outsourcing within the MBE Corporation, the critical element was for MBE decision makers to use available resources as they worked on identifying the best match to their corporation. The following recommendation was shared with MBE; in a study about investment outsourcing, financial advisors selected a turnkey assent management program (TAMP) due to the simplicity. The selection of TAMP is important because the firm does not have to deal with potential technology messes or multiple providers. Firms may select the type of outsourcing that best match personal organizations. For example, TAMP is one provider that handles all aspects of outsourced portfolio management. Buttell (2011) mentioned that TAMP provides investment advisers, automated rebalancing, statements, performance reports, record keeping, and other back office functions. MBE would have benefited from available resources; unbundled, TAMP is one overarching outsourcing provider which separates services provided in the TAMP so that organizations can select distinct providers for each service. With customized solutions, the adviser finds individual providers to perform differing functions in outsourcing investment management.

LIMITATIONS AND FUTURE RESEARCH RESULTS

The constraint of this follow-up research relates to the following (a) the sample participants were from one location, the MBE facility; (b) the objective was to gain sample participants personal experience on conducting customer service in-house; and (c) allotted time for the face-to-face interviews. The limitation of participant to one facility could be a contributor to obstruction of the case study generalization to a larger population sample. To further explore this topic, upcoming researchers could investigate sample participants from several electronic corporations both in domestic and global platforms to identify their desire to outsource and perform cross-analysis with findings of this MBE research. In addition, research on diverse types of organizations and comparing to MBE case analysis could add on to existing research and provide validation if indeed outsourcing outweighs conducting some services in-house as organizations struggle remain competitive.

CONCLUSION

The purpose of this qualitative follow-up research was to conduct a follow-up with the MBE Corporation decision makers to track the effects if any of the initial case analysis and weigh out MBE's stand on the 2013 case analysis (see Appendix A) that had outlined benefits of using in-house workforce to conduct customer service tasks. Specifically, this follow-up case analysis was to determine if the benefits of conducting customer service using in-house workforce outweighed the benefits of outsourcing to third-party specialized companies. The research findings confirm that opting for outsourcing could provide avenues for MBE Corporation of gaining benefits such as opportunities to improve performance, increase efficiencies, lower costs, and increase the focus on core competencies. In a research study by Choi and Chung (2011), jobs processed by vendors do require paying an outsourcing cost and the notion of MBE choice to outsource supports previous research conducted by Tajdini and Nazari (2012) that proper outsourcing choices could lead to success because outsourcing removes the need to recruit, train, and retain experienced and qualified professionals. In contrast, Vasiliauskiene, Snieska, and Venclauskiene (2011) research confirmed that proper outsourcing can shorten lead times in each job performed. In outsourcing decisions, a firm will perform an activity in-house when the firm anticipates high transaction costs and outsource an activity when the firm expects low transaction costs. Similarly, Pouder et al. (2011) mentioned that the transaction costs should include negotiating, monitoring, enforcing, and resolving contract disputes. Aktas et al. (2011) and Rahman (2011) confirmed that outsourcing allows firms to improve customer service, employee morale of the user companies, and lack of time to acquire the resources. Similarly, Schoenherr's (2010) research confirmed that outsourcing allows organizations to access to natural resources, long-lasting contracts with vendors, and lack of patents; and reduces capital investment.

This study was conducted in 2015 and compared to a similar study conducted in 2013 (see Appendix A) among the same managers in the MBE Corporation. The findings can assist in providing an increased awareness of the benefits and factors affecting outsourcing outcomes to ensure outsourcing firms remain successful. The service-outsourcing decision makers can also use the research results to understand the appropriate strategies for firms' leaders to outsource. The decision makers can use the information for selection of outsourcing vendors, checking on progress, formation, and maintaining vendor-client relationships that might lead to fewer outsourcing failures. The results of the study might benefit society by revealing the relationships between decision-making and formation of client-vendor outsourcing relationships. The insights into the factors and relationships that should influence outsourcing leaders' choice regarding the formation of client-vendor may provide greater understanding in approaching the needs of all outsourcing organizations.

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REFERENCES

Adegbie, F., & Adeniji, A. A. (2011). The competitive advantage of outsourcing the products and services of the Nigerian service industry. *Interdisciplinary Journal of Contemporary Research in Business*, *3*, 77-88. Retrieved from http://www.ijcrb.webs.com

Aktas, E., Agaran, B., Ulengin, F., & Onsel, S. (2011). The use of outsourcing logistics activities: The case of Turkey. *Transportation Research Part C: Emerging Technologies*, *19*, 833-852. doi:10.1016/J.Trc.2011.02.005

Anderson, S. (2010). Global outlook: Cover story - Outsourcing goes into high gear. *Foreign Direct Investment.* Retrieved from http://www.ftadviser.com

Benito, G. R., Dovgan, O., Petersen, B., & Welch, L. S. (2012). Offshore outsourcing: A dynamic, operation mode perspective. *Industrial Marketing Management*, *42*, 211-222. doi:10.1016/j.indmarman.2012.08.003

Boeije, H. (2010). *Analysis in qualitative research*. Thousand Oaks, CA: Sage.

Bouchet, A. (2010). Linking outsourcing of sponsorships to athletic department strategy: An agency perspective. *Journal of Sponsorship*, *3*, 277-283. Retrieved from http://journals.cluteonline.com

Buttell, A. E. (2011). Avoiding the pitfalls of investment management outsourcing. *Journal of Financial Planning*, *24*, 24-31. Retrieved from http://journals.cluteonline.com

Chen, H., Tian, Y., Ellinger, A. E., & Daugherty, P. J. (2010). Managing logistics outsourcing relationships: An empirical investigation in China. *Journal of Business Logistics*, *31*, 279-299. doi:10.1002/j.2158-1592.2010.tb00152.x

Choi, B. C., & Chung, J. (2011). Two-machine flow shop scheduling problem with an outsourcing option. *European Journal of Operational Research*, *213*, 66-72. doi:10.1016/J.Ejor.2011.03.017

Cook, M. L. (2010). *Outsourcing in-service education: The effects of a Canadian pedagogical programme on Japanese teachers' of English teaching practices* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 856362489)

Cordella, A., & Willcocks, L. (2010). Outsourcing, bureaucracy and public value: Reappraising the notion of the "contract state". *Government Information Quarterly*, *27*, 82-88. Retrieved from http://www.journals.elsevier.com

Contractor, F. J., Kumar, V., Kundu, S. K., & Pedersen, T. (2010). Reconceptualizing the firm in a world of outsourcing and offshoring: The organizational and geographical relocation of high-value company functions. *Journal of Management Studies*, *47*, 1417-1433. doi:10.1111/j.1467-6486.2010.00945.x

Desai, R., & Mcgee, R. W. (2010). Is outsourced data secure? *The CPA Journal*, *80*, 56-59. Retrieved from http://journals.cluteonline.com

Dollatabady, H., & Forghani, P. (2011). Determining factors affecting on customer satisfaction in outsourcing IT services in University of Isfahan. *Interdisciplinary Journal of Contemporary Research in Business*, *3*, 775-782. Retrieved from http://journals.cluteonline.com

Dube, A., & Kaplan, E. (2010). Does outsourcing reduce wages in the low-wage service occupations? Evidence from janitors and guards. *Industrial & Labor Relations Review*, *63*, 287-306. Retrieved from http://www.ilr.cornell.edu/ilrreview/

Easton, G. (2010) Critical realism in case study research. *Industrial Marketing Management, 39*, 118–128. Retrieved from http://www.elsevier.com

Gandhi, S. (2011). *An analytical characterization of outsourcing risks* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 3428882)

Gunasekaran, A., & Irani, Z. (2010). Modelling and analysis of outsourcing decisions in global supply chains. *International Journal of Production Research*, *42*, 301-304. doi:10.1080/00207540903174775

Hajebi, A., Motevalian, A., Amin-Esmaeili, M., Hefazi, M., Radgoodarzi, R., Rahimi-Movaghar, A., & Sharifi, V. (2012). Telephone versus face-to-face administration of the structured clinical interview for diagnostic and statistical manual of mental disorders, fourth edition, for diagnosis of psychotic disorders. *Comprehensive Psychiatry*, *53*(5), 579-583. doi:10.1016/j.comppsych.2011.06.001

He, C., Weeks, D. E., Buyske, S., Abecasic, G.R., Stewart, W. C., & Matise, T. C. (2011) Enhanced genetic maps from family-based disease studies: Population-Specific comparisons. *BMC Medical Genetics, 12*, 15. doi:10.1186/1471-2350-12-15

Henderson, L. (2011). 20 years partnering in clinical trials. *Applied Clinical Trials, 20*, 10. Retrieved from http://appliedclinicaltrialsonline.findpharma.com

Holley, L. (2011). Telecommunications: The region's growing customer service industry. *Americas Quarterly*, *5*, 107. Retrieved from http://www.americanquarterly.org

Hunter, J. D., & Hall, A. N. (2011). From the shadows into the light: Let's get real about outsourcing. *Journal of Management and Organization, 17*, 77-94. doi:10.5172/jmo.2011.17.1.77

Jain, V. (2011). The expert opinion. *Journal of Global Information Technology Management, 14*, 84-87. Retrieved from http://www.ivylp.com/catalog/item/4569041/4613591.htm

Klingenberg, W. W., & Boksma, J. D. (2010). A conceptual framework for outsourcing of materials handling activities in automotive: Differentiation and implementation. *International Journal of Production Research*, *48*, 4877-4899. doi:10.1080/00207540903067177

Kocaga, Y. (2010). *Essays on capacity sizing and dynamic control of large-scale service systems* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 3418077)

Kshetri, N., & Dholakia, N. (2011). Offshoring of healthcare services: The case of US-India trade in medical transcription services. *Journal of Health Organization and Management, 25*, 94-107. doi:10.1108/14777261111116842

Lindlof, T.R., & Taylor, B. C. (2010). *Qualitative communication research methods*. Thousand Oaks, CA: Sage.

Merriam, S. B. (2010). Qualitative case studies. *International Encyclopedia of Education, 3*, 456-462. doi:10.1016/B978-0-08-044894-7.01532-3

McDonald, R. (2010, July 1). Embracing the middleman. *Business & Finance Magazine*. Retrieved from http://www.usi.edu/business/gbfr/

Monaghan, K. (2011). *Examining the relationship between passenger airline aircraft maintenance outsourcing and aircraft safety* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 3442986)

Mosher, R., & Mainquist, D. (2011). The outsourcing relationship. *Internal Auditor*, *68*, 35-39. Retrieved from http://www.theiia.org/intauditor/

Mowla, M. M. (2012). An overview of strategic alliance: Competitive advantages in alliance constellations. *Journal of Business, 1*, 1-10. Retrieved from http://www.onlineresearchjournals.org

Niranjan, T. T., & Rao, S. S. (2011). A toolkit for balanced outsourcing. *Industrial Management, 53*, 19-24. Retrieved from http://www.emeraldinsight.com

Oliveira, M., Hartung, K., & Wendling, M. (2010). Outsourcing and offshore: An analysis of the academic literature. *Portuguese Journal of Management Studies, 15*, 215-234. Retrieved from http://pascal.iseg.utl.pt/~pjms

Pouder, R. W., Cantrell, R., & Daly, J. P. (2011). The impact of outsourcing on firm value: New insights. *SAM Advanced Management Journal, 76*, 4-13. Retrieved from http://www.cob.tamucc.edu/sam

Ravindran, K (2010). *Governance mechanisms in information technology outsourcing* (Doctoral dissertation). Available from ProQuest Dissertations & Theses database. (UMI No. 3404761)

Rahman, S. (2011). An exploratory study of outsourcing 3PL services: An Australian perspective. *Benchmarking: An International Journal, 18*, 342-358. doi:10.1108/14635771111153527

Rajbir, S. B., Kumar, P., & Kumar, D. (2010). Analytical modeling of third-Party service provider selection in lead logistics provider environments. *Journal of Modeling in Management, 5*, 275-286. doi:10.1108/17465661011092641

Schoenherr, T. (2010). Outsourcing decisions in global supply chains: An exploratory multi-country survey. *International Journal of Production Research*, *48*, 343-378. doi:10.1080/00207540903174908

Sinha, P., Akoorie, M. E., Ding, Q., & Wu, Q. (2011). What motivates manufacturing SMEs to outsource offshore in China? Comparing the perspectives of SME manufacturers and their suppliers. *Strategic Outsourcing: An International Journal*, *4*, 67-88. doi:10.1108/17538291111108435

Speter, K. (2011). Globalization: The changing views of American college students (2007 -2010). *International Business & Economics Research Journal*, *10*, 53-55. Retrieved from http://journals.cluteonline.com

Susarla, A. (2012). Contractual flexibility, rent seeking, and renegotiation design: An empirical analysis of information technology outsourcing contracts. *Management Science*, *58*, 1388-1407. doi:10.1287/mnsc.1110.1493

Tajdini, S., & Nazari, M. (2012). IS outsourcing decision: A quantitative approach. *International Journal of Business and Management, 7*, 113-129. doi:10.5539/ijbm.v7n2p113

Tambe, P. B., & Hitt, L. M. (2010). How offshoring affects IT workers. *Communications of the ACM*, *53*, 62-70. doi:10.1145/1831407.1831426

Vasiliauskiene, L., Snieska, V., & Venclauskiene, D. (2011). Evaluation of outsourcing models determining the variation of transaction costs. *Economics & Management*, *16*, 28-436. Retrieved from http://www.jbem.lt

Walls, J. (2010). Regions: Americas - The U.S. marches on. *Foreign Direct Investment.* Retrieved from http://www.ftadviser.com/InvestmentAdviser

Whitaker, J., Mithas, S., & Krishnan, M. S. (2010). Organizational learning and capabilities for onshore and offshore business process outsourcing. *Journal of Management Information Systems, 27*, 11-42. doi:10.2753/MIS0742-1222270302

Zirpoli, F., & Becker, M. (2011). What happens when you outsource too much? *MIT Sloan Management Review, 52*, 59-64. Retrieved from http://sloanreview.mit.edu

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APPENDIX A: FACTORS INFLUENCING MBE DECISION TO OUTSOURCE

2013 Case Study Findings	2015 Case Study Findings
(a) Cost reduction and innovation: outsourcing removes the need to recruit, train, and retain an experienced and qualified professional	(a) Gaining benefits such as opportunities to improve performance; MBE would outsource to gain access to skilled labor in customer service
(b) Clients achieve a competitive advantage by enforcing cost reductions, especially with respect to labor costs and focusing on core competency	(b) Increase efficiency, MBE would benefit by the opportunity of utilizing an outsourcing firm expertise to handle consumer relations
(c) Improve performance, whereby firms outsource for access to specific skilled labor; and (d) firm can gain efficiencies	(c) Lower costs, MBE would omit the need to hire, provide training, and maintain experienced workforce in customer service; and
(d) Firm can gain efficiencies	(d) Increasing focus on core competencies

COVID-19 IMPACT ON RETAILING

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ABSTRACT

In early 2019, retailers had reason to be optimistic. Unemployment was low and while many retailers closed branches, overall, retailing rose. The hospitality and travel industries were at their highest revenue levels in more than 16 years and consumer spending was at a high. Traditional retail formats were no longer working as omnichannel retailing took hold. Very few could have predicted that retail employees would become essential workers as a pandemic hit the world. The retailing industry took a major hit and experts are unsure about a total recovery. In this paper we examine the impact of COVID-19 on retail environments and what the future of retailing may hold.

INTRODUCTION

The retail industry has had its ups and downs over the past few years such that the term "retail apocalypse" became popular. The trend away from big box stores to boutique stores and the growth of online retail led to closures of traditional brick and mortar stores. 2019 was a record-breaking year as over 9,300 stores closed in the U.S., a 63% increase from 2018. While some viewed the retail landscape as apocalyptic, others viewed it as in transition. According to a 2019 report from IHL Group, the press tends to focus on negative news. Their report shows that although stores were closing in record numbers, since January 2017, the industry actually increased sales by $565.7 billion and added 8,575 stores. Of the retail segments examined, the apparel and department store chains experienced the most net closures. From 2017-2019 there were net closures of 9,651 stores. In 2019 there were more than five retail chains opening stores for every store closing. Most of the growth came from food/drug/convenience/mass merchants and restaurants.

In early 2019, retailers had reason to be optimistic. Unemployment was low and while many retailers closed branches, overall, retailing sales rose. The hospitality and travel industries were at their highest revenue levels in more than 16 years and consumer spending was at a record $13.2 trillion (Repko, Josephs, Wayland & Lucas, 2020). Traditional retail formats were no longer working as omnichannel retailing took hold. Very few could have predicted that retail employees would become essential workers as a pandemic hit the world.

In this paper we examine the impact of COVID-19 on retail environments and what the future of retailing may hold.

ENTER COVID-19

In the Fall of 2019, the novel SARS-CoC-2 coronavirus emerged in Wuhan, China (Scripps Research Institute, 2020). On December 31st, 2019, spokespeople from China told the World Health Organization (WHO) of an outbreak of a novel strain of coronavirus causing severe illness (Ibid, 2020). This was the beginning of a pandemic that caused harm to both human health and world economies. On March 11, 2020, the World Health Organization declared the coronavirus outbreak a pandemic. It was determined that the virus was natural and not lab manufactured.

COVID-19 Timeline

Retail Customer Experience (2020) tracked the environmental impact of the virus on retailers. The following highlights are modified from Retail Customer Experience (Mottl, 2020):

January 31, 2020: Coronavirus likely to impact airport travel, retail worldwide
March 13, 2020: Questions surface about payment methods for retailers. Digital versus Cash
March 16, 2020: Retailers close stores for worker safety and customer safety
March 17, 2020: Amazon is hiring 100k workers to keep up with online sales increases
March 19, 2020: Grocers begin to hire more to meet demand
March 24, 2020: Retail industry begin lobbying for federal support
March 25, 2020: Retailers begin to set up 'special' shopping times for seniors

March 27, 2020: Stimulus package to offer $350 Billion in small business loans. $2 Trillion rescue package offered to businesses and employees
March 30, 2020: Federal CARES Act provides relief
April 1, 2020: Walmart begins checking employee temperature before shifts
April 6, 2020: Amazon begins to deploy masks and taking worker's temperatures
April 7, 2020: Target workers get masks, gloves…customers get more space.
April 8, 2020: Self-service grows
April 16, 2020: Some retailers prepare to open; The Nebraska Mall gets ready to reopen. Walmart sets special pickup hours for their COVID high-risk customers
April 21, 2020: COVID-19 drives e-commerce upward 'big time'. Treatment of essential workers impacting consumer decision-making
April 27, 2020: The U.S. House approves an additional $484B in relief funds for small businesses, testing and hospitals
April 30, 2020: Social distancing drives changes in the way consumers spend their money
May 5, 2020: Consumer mindsets are shifted during the virus outbreak
May 11, 2020: The NRF says the retail recovery will be gradual
June 8, 2020: The National Bureau of Economic Research announces the United States is in a recession, which began in February 2020

IMPACT OF PANDEMIC ON RETAIL ENVIRONMENTS

In the following section we look at the main environments impacting retailers and how COVID-19 has impacted these environments. Keep in mind that these environments are related to each other and often overlap. A combination of these environments could also provide threats and/or opportunities for retailers.

The Social Environment

The social environment includes consumer behavior and insights as well as how the social environment may be changing.

Retailing, and in particular brick and mortar retailing is a social activity. When the pandemic hit the United States in Feb/Mar 2020, stay-at-home and shelter-in-place orders shocked the operations of brick and mortar retailers. Most people stayed home except for essential trips. Those people that were required to go to work during this time were deemed "essential". Essential businesses like grocery stores, banks, and drug stores remained open. Especially hit were service retailers such as restaurants and bars, salons, and entertainment venues. The orders to stay home were lifted region by region based on guidelines issued by the CDC (2020).

Even when stay at home orders were lifted, retailing changes are apparent. Social distancing, less people in stores, protections for employees, food shortages and purchase limits, increased credit card usage, reduced hours, and curbside pickup changed consumer behaviors.

Impact of COVID-19 on Consumer Psyche

When asked about potential changes in consumer motivations, retail guru, Paco Underhill, CEO of Envirosell and best-selling author, responds, "The monster of consumption is intact" (2020, personal interview). While consumer demand for some products and categories may ebb and flow over the next few years, like durable luxury goods, it is probable that consumer desire to consume will change very little post COVID-19. This desire for products and services resides deep within the human psyche which seeks to maintain stable levels of psychological assets related to the self, such as self-esteem, belongingness, feelings of power, and feelings of control over one's environment (Crocker & Park, 2004; Kay, Wheeler, & Smeesters, 2008; Leary, Tambor, Terdal, & Downs, 1995; Whitson & Galinsky, 2008).

How long will the effects of the coronavirus remain in consumer's psyches? It is unclear. Products serve as "psychological" salve to reduce distress (Mandel, Rucker, Levav, & Galinsky, 2017). Often to maintain stable human psyche levels, individuals monitor the congruence between their present state (or actual self) and a goal state (or ideal self) (Carver & Scheier, 1990; Higgins, 1987). When a person perceives a self-discrepancy, or an inconsistency between one's ideal and actual self, she seeks to correct the discrepancy (Higgins, 1987). For many consumers this

results in altered consumer behavior. It is evident that the pandemic is affecting psychological functioning. A study by NORC at the University of Chicago (2020) reports that people's happiness is the lowest it has been in fifty years. The study, conducted in May 2020, reports that only 14% of American adults say they are very happy compared to 31% in 2018, a 17% drop.

The Government/Political Environment

The government and political environment includes information on laws and how political decisions are impacting retail operations. The goal of government is to help consumers and businesses. With unemployment at record highs, the government is playing a key role in information and aid.

To help the economy, Congress passed a $1.7 trillion economy relief package called the CARES Act (Coronavirus Aid, Relief and Economic Security). The money provided financial assistance for Americans, small businesses, and low-and middle income citizens. As part of the package, the federal government issued economic impact checks. While amounts varied, eligible taxpayers received a payment of $1,200 for individuals ($2,400 for married couples) and up to $500 for each qualifying child. As of June, 2020, a second stimulus check had been proposed by congress.

Early on both major political parties politicized the virus outbreak. There was a wide partisan gap on views of President Trump's response to the outbreak. 83% of Republicans and people who lean Republican rate Trump's response as either excellent or good while only 18% of Democrats and Democratic leaners agree. In addition, according to the Pew Research Center (Green & Tyson, 2020):

1. Democrats/Democratic leaners are more likely than Republicans/Republican leaners to see the coronavirus in the most serious terms. 78% of Democrats and people who lean Democrat believe the outbreak is a major threat to the U.S. population while 52% of Republicans and people who lean Republican feel the same.

2. Both Parties (Democrats, 36% and Republicans, 30%) say that someone in their household has either lost a job or taken a pay cut due to the coronavirus outbreak.

3. The two major parties differ on how people across the country are reacting to the outbreak. Republicans/Leaners were more likely to say that people in the U.S. are overreacting to the outbreak (39%) than Democrats/Leaners (25%). 31% of Republicans/Leaners believe that people in the U.S. are not taking the virus seriously enough while 48% of Democrats/Leaners believe this.

2020 is an election year so political ads and issues are prevalent. As many have said, the coronavirus does not care about a person's political stance. Yet one's political stance does impact retailing. According to retailing expert, Erin Jordan, politics play a role in changing people's perspectives on the economy and this may impact consumer spending. She says that consumers look at brands as extensions of themselves and are more aware of retailers' social stances as they represent their own lifestyle (Danziger, 2018).

The Technological Environment

The technological environment includes changes and improvements in technology that help consumers and/or retailers. The World Economic Forum (2020) lists technology trends that have emerged during the pandemic. Trends impacting retailing include:

1. The growth of online shopping and contactless delivery, including using robots for delivery
2. Increase in digital and contactless payments
3. Increase in remote work arrangements
4. Rise in health care organizations providing telehealth services
5. Internet and streaming technology allowed many types of technology to move online
6. Usage of technologies in supply chain management increased including cloud computing, Big Data, Internet-of-Things (IoT), circular economy, and blockchain (electronic ledger used to record cryptocurrency transactions)
7. Increase is usage of 3-D Printing to make health care equipment such as masks and ventilators
8. The use of robotics and drones increased for such things as cleaning, food delivery and walking dogs

Retail innovations such as improvements in POS (point of sale) systems, augmented shopping, staff-free stores, and the use of artificial intelligence will continue to evolve as consumers navigate the new normal.

The Economic Environment

The economic environment includes information on employment, sales, and trends. As a result of shutting down the economy, world economies were faced with two big problems. On the supply side, supply chains became fractured as producers closed to protect their workers. Manufacturers struggled to find product sources and transportation was interrupted. On the demand side, consumer spending dropped sharply. During the first quarter of 2020, millions of people lost their jobs and consumer confidence plunged to historic lows.

The Consumer Confidence Index (CCI) is based on answers from consumers about their financial situation, unemployment, and capability of savings. An indicator above 100 means consumers are confident about the future economic situation and are more inclined to spend. An indicator below 100 means that consumers are pessimistic about the future economy and tend to save more and consume less (OECD Data, 2020). The Conference Board noted that in April 2020, its confidence index tumbled to a reading of 86.9, the lowest level in nearly six years and down from 118.8 in March of the same year (CNBC, 2020).

Low consumer confidence and, in some instances, constrained supply channels during the first quarter of 2020, had a profound negative effect on the U.S. economy. According to the Bureau of Economic Analysis (2020), consumer spending dropped a record 13.6% in April 2020. The unemployment rate went from one of the lowest on record at 3.8% in February 2020 to one of the highest on record at 14.4% in April 2020. Due to the pandemic, the number of unemployed Americans grew from 6.2 million in February 2020 to 20.5 million in May 2020 (Pew Research Center, 2020).

On June 8, 2020, The National Bureau of Economic Research announced the United States is in a recession, which began in February 2020. Economists are unsure what shape the economic recovery will take.

Retailers are hoping that pent-up demand will result in a return to pre-pandemic sales levels. Others fear that people will realize they do not need as much, especially with the possibility of unemployment looming. It is clear that people are more likely to return to brick and mortar shopping if they feel safe. In response, retailers have developed plans around how to disinfect stores and how to communicate safety measures to customers. Until a vaccine is developed, social distancing and people wearing masks in public spaces may become the norm.

The Natural Environment

The natural environment may include things like natural resources, terrain, physical barriers for customers, the climate, disease and pandemics, pollution, and other areas.

Any time there is a world-wide pandemic, retail is impacted. Based on past experience, scientists have learned much about disease spread, hygiene, and treatments that are helping people and businesses navigate the changing environment.

Currently the pandemic is getting the most attention due to the far reaching impact but there are other disasters that occurred in 2020 that also impact retailing including wildfires, flooding, and earthquakes. An unexpected benefit of the pandemic was the cleaner air that resulted from less cars on the road and the shutdown of many pollution-causing businesses. Early in April 2020, daily global carbon emissions were down by 17% compared to 2019. The gains may be short-lived as the economy opens again. Corinne Le Quéré, professor of climate change at the University of East Anglia (Britain), fears that the carbon output could exceed pre-COVID-19 levels because during the 2007/08 financial crisis, emissions bounced back after the crisis ended (Gardiner, 2020).

THE FUTURE

Radical Changes in Retailing

According to McGahan (2014, para 10), radical transformation of an industry is unusual and occurs when "both core activities and core assets are threatened with obsolescence." There has to be new technology, regulatory changes, changes in consumer tastes or some other crisis that forces transformation. For the retailing industry, the crisis may be COVID-19. There are many areas of concern for the retail industry including insurance, travel, automotive, entertainment and department stores. There are many businesses operating in a limited capacity or that have ceased operations permanently. By May 2020, 260,000 U.S. retailers had temporarily closed their stores during the coronavirus outbreak (Bhattarai, 2020).

Of particular concern are regional shopping centers. The demise of malls has been forecasted for years. Retail expert and consultant, Paco Underhill (personal interview, 2020) is far more optimistic. He posits that there are many strategies that, although not often utilized within the U.S., could breathe life and foot traffic into the malls. For example, bringing a day-care center into a mall would not only attract young parents, but would be appealing for a mall tenant selling children's goods. Underhill suggests malls consider leasing space for offices, apartments, churches, schools, medical practices, upscale grocers, and libraries. Underhill goes on to state that the most underused asset for malls is the crumbing parking lot. One could imagine seasonal pop-up shops or mobile food and retail trucks.

Changing Consumer Behavior

According to a May 2020 survey by Salesforce Research, due to the convenience and the positive experience during the stay at home orders, many customers will continue to buy items online even after the pandemic. To return to stores, consumers need assurance of safety precautions such as social distancing measures and use of personal protection equipment for employees and customers. Many consumers indicate they will not return until there is wide-spread availability of COVID-19 testing and/or a vaccine. Older people tend to more cautious with return to in-store interactions.

Experts predict that COVID-19 will significantly change our lives. Shown below are some of their predictions that impact retailing (Hochman, 2020):

Expert	Prediction
Eric Toner, M.D., Senior Scholar, Johns Hopkins Center for Health and Security	Mask wearing may draw political and generational lines.
Rami el Samahy, Boston Architect	"'Clean' is the new 'green'" (p. 10) as businesses make clear their elevated hygiene efforts.
Tim Wu, New York Times opinion columnist and author of "The Curse of Bigness"	The distance economy will grow as people are using online to buy things never considered before the pandemic
Ken Doctor, Media Analyst	The pandemic is an "extinction event" for the newspaper industry
Jeffrey Cole (2020), Director for the Center for the Digital Future	Going to the movies may be replaced by streaming at home. If movie theatres survive, the industry will be much smaller.
Abraham Madkour, Publisher and Executive Editor of Sports Business Journal	The Fear of Going Out (FOGO) will grow as people avoid large crowds. Sports events will operate at 25 – 30% capacity with strict attendance standards such as segmented arrival times.
Bert Sperling, Founder of BestPlaces.net	Society will rethink commuting as less people opt to take mass transportation.

Brian Kelly, The Points Guy founder	Rental shares such as Airbnb will face less consumer demand as staying in someone's house becomes less appealing during a pandemic.
Nora Super, Senior Director of the Milken Institute's Center for the Future of Aging	People are considering moving to less populated cities. Older people considering downsizing may stay put as space is more desirable.

The implications on in-store merchandising and hygiene will also be critical to successful retailing. Underhill (personal interview, 2020) points out the need for retailers to consider hygiene from two perspectives – design and operationally. The design of the space, the interaction with products, traffic flow, signage, furniture, employee engagement, entrances and exits are all considerations that retailers must now address. Operationally, stores must be cleaned and disinfected more often and will likely require greater expense in terms of equipment, cleaning products, and labor.

CONCLUSION

Many retail experts predict more retail closures in the months and years ahead. Camilla Yanushevsky, a retail stock analyst for CFRA Research, states that "The companies that are most at risk are the ones that were already distressed before the crisis" (Bomey, 2020, para 13). Retailing will be forever defined as before COVID-19 and after COVID-19. We do not yet know how different the before and after will be. Even after the economic fallout is calculated, there will be questions that remain unanswered. The role of planning, technology, employees, and information security may play a greater role as retailers move forward. Retailers are being asked to perform under extraordinary uncertainty. The "new normal" may not include small businesses and some iconic brands, who were unable to recover. Still, there will be entrepreneurs who leverage the changes to create new retail establishments.

Retailers of all sizes need to gain a deeper understanding of their markets to better connect with their customers. The pandemic shutdown may provide opportunities for retailers to examine their brands in terms of brand promise, brand message, and brand attributes. Doing so will empower retailers to better understand and align their own purpose, mission, and vision, for their stakeholders.

REFERENCES

Bhattarai, A. (2020). Sales soar at Walmart and Home Depot during the pandemic. *The Washington Post* (May 19). Retrieved from https://www.washingtonpost.com/business/2020/05/19/walmart-earnings-economy-coronavirus/

Bomey, N. (2020). Can These 13 Retailers survive coronavirus? Permanent store closings, Bankruptcies Coming. *USA Today* (May 8). Retrieved from https://www.usatoday.com/story/money/2020/05/08/store-closings-chapter-11-bankruptcy-coronavirus-covid-19/3090235001/

Bureau of Economic Analysis (2020). *Consumer Spending*. Retrieved from https://www.bea.gov/data/consumer-spending/main

Cole, J. (2020). Jeffrey Cole: Perspectives on the digital realm (April 22). *Center for the Digital Future*. Retrieved from https://www.digitalcenter.org/cole/

Carver, C. S., & Scheier, M. F. (1990). Origins and functions of positive and negative affect: A control-process view. *Psychological Review*, *97*(1), p. 19.

Centers for Disease Control (2020). Fact Sheet: What You Should Know about COVID-19 to Protect Yourself and Others. Retrieved from https://www.cdc.gov/coronavirus/2019-ncov/downloads/2019-ncov-factsheet.pdf

CNBC (2020). Economy: Consumer confidence plunges in April as millions lose jobs. Online (April 28). Retrieved from https://www.cnbc.com/2020/04/28/us-consumer-confidence-april-2020.html?

Crocker, J. & Park, L. E. (2004). The costly pursuit of self-esteem. *Psychological Bulletin*, *130* (May), 392-414. DOI: 10.1037/0033-2909 .130.3.392.

Danziger, P. N. (2018). Trump economy has powered consumer spending, but politics affect where people shop. *Forbes* (June 8). Retrieved from https://www.forbes.com/sites/pamdanziger/2018/06/08/trump-economy-has-powered-consumer-spending-how-retailers-can-make-it-sustainable/#d93c98a59bf0

Gardiner, B. (2020). Why COVID-19 will end up harming the environment. *National Geographic* (June 18). Retrieved from https://www.nationalgeographic.com/science/2020/06/why-covid-19-will-end-up-harming-the-environment/

Green, T. V. & Tyson, A. (2020). 5 facts about partisan reactions to COVID-19 in the U.S. *Pew Research Center*. Retrieved from https://www.pewresearch.org/fact-tank/2020/04/02/5-facts-about-partisan-reactions-to-covid-19-in-the-u-s/

Higgins, E. T. (1987). Self-discrepancy: A theory relating self and affect. *Psychological Review*, *94*, 319-340.

Hochman, D. (2020). What comes next. Experts predict how the pandemic will change our lives. *AARP Bulletin* (June), 10-12.

Kay, A. C., Wheeler, S. C., & Smeesters, D. (2008). The situated person: Effects of construct accessibility on situation construals and interpersonal perception. *Journal of Experimental Social Psychology*, *44*(2), 275-291.

Leary, M. R., Tambor, E. S., Terdal, S.K., & Downs, D.L. (1995). Self-esteem as an interpersonal monitor: The sociometer hypothesis, *Journal of Personality and Social Psychology*, *68*(3), 518-30.

Mandel, N., Rucker, D. D., Levav, J., & Galinsky, A. D. (2017). The Compensatory consumer behavior model: How self-discrepancies drive consumer behavior. *Journal of Consumer Psychology*, *27*(1), 133-146. doi:http://dx.doi.org.ezaccess.libraries.psu.edu/10.1016/j.jcps.2016.05.003

McGahan, A. M. (2020). How industries change. *Harvard Business Review* (Oct 2004). Retrieved from https://hbr.org/2004/10/how-industries-change

Mottl, J. (2020). Following COVID-19: How coronavirus pandemic is impacting retail, *Retail Customer Experience* (May 12). Retrieved from https://www.retailcustomerexperience.com/articles/following-covid-19-how-coronavirus-pandemic-is-impacting-retail/?style=print

NORC at the University of Chicago (2020). Issue brief: historic shift in americans' happiness amid pandemic. Retrieved from https://www.norc.org/PDFs/COVID%20Response%20Tracking%20Study/Historic%20Shift%20in%20Americans%20Happiness%20Amid%20Pandemic.pdf

OEDC Data: Consumer Confidence Index (Jan 2014 - May 2020). Retrieved from https://data.oecd.org/leadind/consumer-confidence-index-cci.htm

Repko, M., Josephs, L. Wayland, M. & Lucas, A. (2020). American companies spent years in an economic boom. then the coronavirus hit. CNBC (Economy), (May 11). Retrieved from https://www.cnbc.com/2020/05/10/american-companies-spent-years-in-an-economic-boom-then-the-coronavirus-hit.html

Salesforce Research (2020). A survey of 3,500+ consumers shows how COVID-19 will transform shopping for the long haul. Salesforce website. Retrieved from https://www.salesforce.com/company/news-press/stories/2020/5/salesforce-research-results/

Scripps Research Institute (March 17, 2020), COVID-19 Coronavirus epidemic has a natural origin. *Science Daily*. Retrieved May 13, 2020 from www.sciencedaily.com/releases/2020/03/200317175442.htm

Underhill, P. (2020). Personal interview conducted via Zoom on May 23, 2020 by Timothy Schauer, Associate Professor of Business and Business Program Chair, Sweet Briar College.

Whitson, J. A., & Galinsky, A. D. (2008). Lacking control increases illusory pattern perception. *Science*, *322*(5898), 115-117.

World Economic Forum (2020). 10 technology trends to watch in the covid-19 pandemic, (Apr 27). Retrieved from https://www.weforum.org/agenda/2020/04/10-technology-trends-coronavirus-covid19-pandemic-robotics-telehealth/

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HOW DID COVID-19 LOCKDOWN MEASURES DURING THE SECOND QUARTER OF 2020 AFFECT THE SALES OF ELECTRICITY TO THE COMMERCIAL SECTOR?

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ABSTRACT

Beginning in late March, the lockdown measures imposed by state governments had dramatic and far-reaching economic effects. As activities considered as non-essential, both private and public, ceased, the Commercial sector was impacted as businesses and governments curtailed or ceased normal operations. This analysis examines the energy consumption in the form of the sales of electricity to the Commercial sector in light of several forecasting methods to assess the impact of the lockdown.

BACKGROUND

Across the entire business sector, with lockdown measures imposed by state governments we have seen dramatic and far-reaching economic effects. With the curtailment of activities considered to be non-essential, both private and public, there was significant impact on the Commercial sector as businesses and governments curtailed or ceased normal operations. The Commercial sector is defined by the Energy Information Agency as service providing facilities and equipment belonging to firms and governments. Common energy uses by this sector include heating, air conditioning, lighting, refrigeration and cooking.

This analysis examines the energy consumption in the form of the sales of electricity to the Commercial sector[II] [Figure 1] in light of several forecasting methods to assess the impact of the lockdown. One can observe the general trend and seasonal nature of the data. The spike in sales occurs between Q2 and Q3 followed by a drop-in-sales in Q4. The pattern then repeats periodically. The impact of COVID-19 is noticeable in Q2 of 2020, where, instead of the hallmark increase typical of Q2 and Q3, one can see the steady decline in sales. The analysis begins with an assessment of quarterly data, and then drills down to the monthly totals in order to compare the forecasts with actual demand.

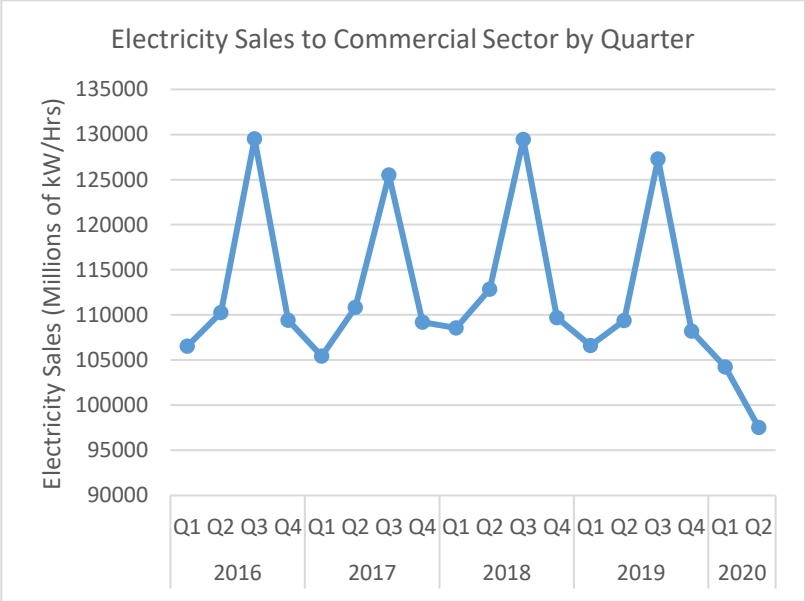

Figure 1: Electricity Sales to the Commercial Sector by Quarter Q1 2016 - Q2 2020

METHODOLOGY

The EIA website, (https://www.eia.gov/electricity/data/browser/#/topic/5?agg=0) is the source of much of the data in this study.

The data provides a rich source upon which one can conduct independent studies and analysis of energy data. In order to perform this analysis, we first organized the data by quarter and by month. Next, several forecasting methods have been applied to determine which forecasting method provides the best single point forecast for Q2 of 2020. The forecasting methods compared will be the 4-point Moving Average, the Exponential, the Simple Linear Regression and the Trend & Seasonal method, (Makridakis, et al, 1998). The quarterly information will enable us to understand the basic features and characteristics of the data.

Once the most appropriate forecasting method is chosen, the single point forecast for Q2 2020 will be compared to the actual data from Q2 2020. Finally, the chosen forecasting method will be used to create projections for the subsequent three quarters, Q3 2020 through Q1 2021 to provide expectations for the post-lockdown recovery.

A secondary analysis of the monthly data will then be performed to provide a more detailed understanding of the impact of COVID-19 and the subsequent lockdown measures on the commercial electricity sector.

We propose the following two hypotheses:

- Due to the seasonal nature of the data, the best forecasting method will naturally be the Trend and Season method.
- We expect that there will be a noticeable decline in electricity sales during Q2 of 2020 versus what is projected by the best available forecasting method.

RESULTS

The results of the analysis are presented in Tables 1a-1c and in Figure 2 which presents the information graphically. In Table 1a, one can examine the forecasts for Electricity sales (in Millions of kW/Hrs), but Table 1b provides the insight as to the applicability of the forecast technique.

A useful way to compare the effectiveness of forecasts is to use the mean average deviation (MAD). When comparing the MAD for the four forecasting methods [Table 1a], a clear best forecasting method emerges. The Trend and Seasonal method (T&S) has the lowest MAD when compared to the other models by at least a factor of six. A similar trend emerges when examining the MAPE.

Indeed, the r-squared value for the Simple Linear Regression and Trend & Season methods are very small, which indicates that there is likely no significant trend component with regards to the time series. An additional statistical test that can be run to confirm the lack of trend would be the analysis of variance (ANOVA), which provides an F-statistic for the slope term. We will discuss this in our analysis of the monthly data.

Looking at the graph of the sales data and forecasting methods [Figure 2], the decline in sales that began in Q1 2020 and intensified in Q2 2020 is quite clear. Returning to the data, the actual sales for Q2 2020, 97,525 million kW/Hrs, was much lower than the T&S model would have predicted for the quarter, a forecast of 110,245 million kW/Hrs. This difference represents a theoretical 11.5% decline from the T&S model baseline. Clearly, the lockdown had a severe effect on business activity as measured by electricity consumption in the Commercial sector.

We will return to this when examining the monthly data. Before doing so, by examining the seasonal index values in Table 1c, we can confirm that the peak sales quarter is indeed Q3 with a seasonal index of 1.125. This indicates that the largest shift in sales of electricity in the commercial sector corresponds to the third quarter, ie July-September, which includes the hotter months and the need for air-conditioning across commercial buildings. Unfortunately, we do not have the data for Q3 of 2020, yet, we can observe that Q2 shows a non-typical decrease in the data.

Having identified the Trend and Seasonal method as the emerging forecasting method, can we examine the data at a finer level of granularity and gain further insight?

Forecast Method	Q2 2020	Q3 2020	Q4 2020	Q1 2021
Four Point	113242	-	-	-
Exponential	109982	-	-	-
Linear Regression	112383	112301	112219	112137
Trend & Season	110245	127019	108283	105812

Table 1a: Forecasts of Electricity Sales to the Commercial sector (Millions of kW/Hrs)

Forecast Accuracy	4 point	Exponential	Linear Regression	Trend & Seasonal
MAD	7170.94	6632.75	6977.28	1029.26
MSE	69035445	104768177	72018428	1653070
MAPE	0.062	0.054	0.060	0.009
R^2 (trend)	-	-	0.00223	0.02904

Table 1b: Forecast Accuracy of methods (quarterly data)

	Q1	Q2	Q3	Q4
Data Set	0.939	0.976	1.125	0.960

Table 1c: Scaled Seasonal Index Used for Trend & Season Method

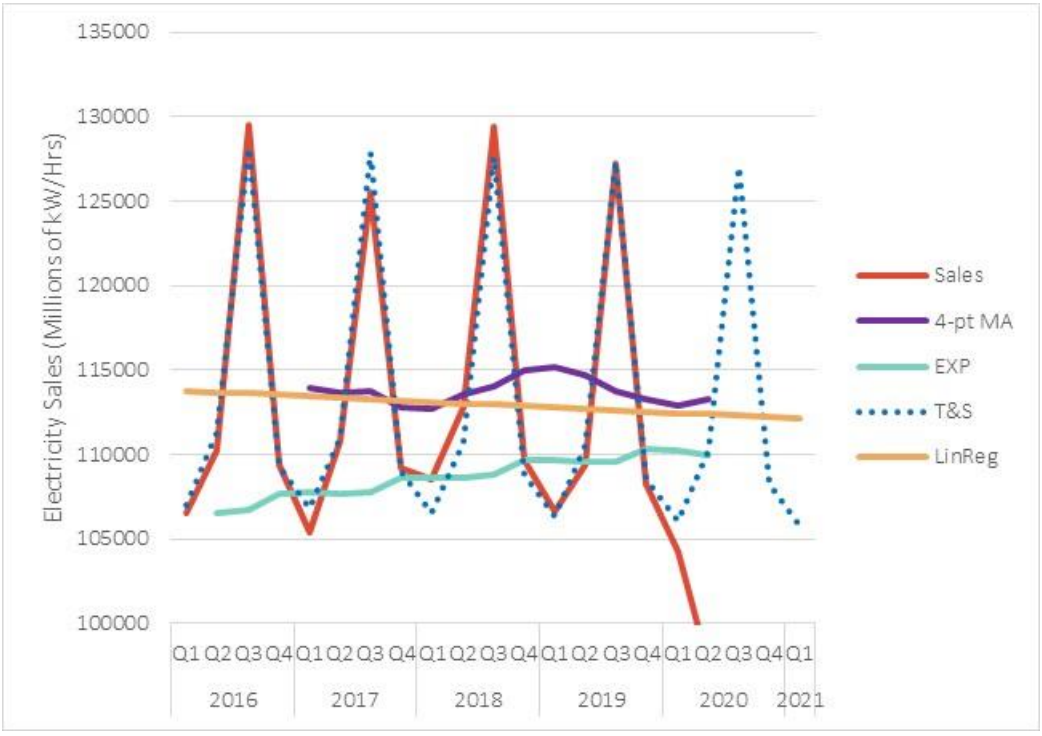

Figure 2: Graphical Summary of the Four Forecasting Methods

Observations from the Monthly Data

Looking at the monthly data, our analysis of the post-COVID response period is somewhat limited by availability. Unfortunately, the most recent month of data collected by the EIA from Q3 of 2020 is from the month of July. However, even with the limited Q3 data, there are interesting insights to be gained regarding the reduction of lockdown mandates and signs of recovery [Figure 3].

The errors when calculating the forecasts using monthly data reflect a similar pattern to those observed in Table 1b. As shown in Table 2, one can observe that the Trend and Seasonal method is superior to all the other forecasting methods examined, and that the error is about six times less.

In April, when lockdown measures in the U.S. became widespread, there was a notable decrease in actual sales volume when compared to the sales volume forecasted by the T&S model. To better assess the initial lockdown period, a comparison to the monthly seasonal index values from the T&S model may be useful [Table 3].

In May, the actual sales showed a small increase month over month from April, slightly less than the typical increase shown in the seasonal index values from April and May, 0.903 and 0.979, respectively. Then, the upward inflection in the actual data increased dramatically, with the volume in June rising to within 10% of the baseline volume forecasted by the T&S model. Finally, in July, a seasonally robust month for electricity sales, with a seasonal index of 1.147, the actual sales volume continued to rally higher, closing to within 2.5% of the baseline volume forecasted by our model. Note the correspondence in the scaled seasonal indices between the quarterly results [Table 1c] and the corresponding values in the monthly results [Table 3].

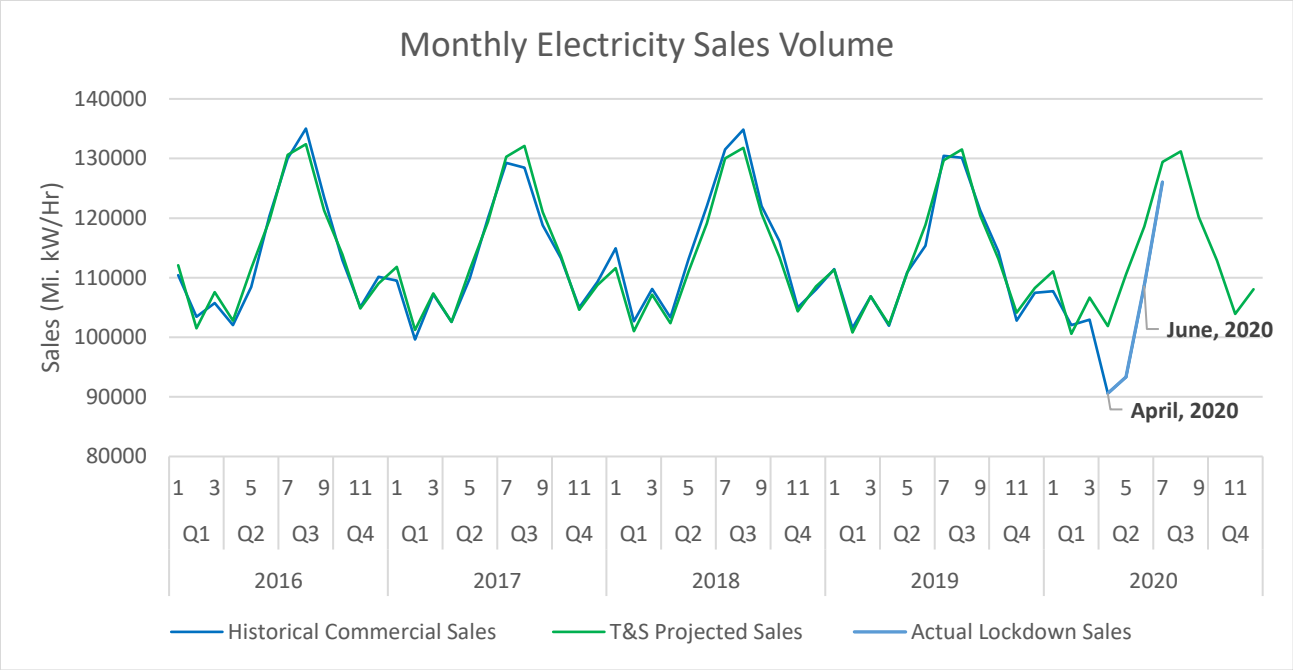

Figure 3: Monthly Electricity Sales Volume for T&S Forecast and Actual Sales

Forecast Accuracy	4 point	Exponential	Linear Regression	Trend & Seasonal
MAD	9702.14	6864.48	8234.50	1450.07
MSE	140593642	60427055	97345213.7	3201970
MAPE	0.084	0.061	0.072	0.013
R^2 (trend)	-	-	0.0018	0.0306

Table 2: Forecast Accuracy of methods (monthly data)

Month	Monthly SI
January	0.983
February	0.890
March	0.944
April	0.903
May	0.979
June	1.048
July	1.147
August	1.163
September	1.066
October	1.002
November	0.921
December	0.958

Table 3: Monthly Seasonal Index Values Used in the T&S Model

EVALUATING THE CHOSEN FORECASTING MODEL

One way to gauge the fit of a linear model to a particular sample is to evaluate the F-statistic derived from an ANOVA. For the monthly data, the Simple Linear Regression model was not significant, with an F-statistic of 0.0876, corresponding to a p-value of 0.76. The Trend and Seasonal model was also not significant as measured by an ANOVA, with an F-statistic of 1.52, corresponding to a p-value of 0.22. However, one weakness of the ANOVA is failing to reject the null hypothesis of the non-zero slope in situations in which the slope parameter (β_1) lies near zero. Our test estimate for this parameter was -21.1 mil. kW/Hr per month, four orders of magnitude smaller than the monthly sales volume.

Turning to alternative methods for predicting forecast accuracy, the Mean Average Percent Error (MAPE) gives us a reasonable standard to compare models. The Simple Linear Regression model had a MAPE of 7.2%. The Trend and Seasonal had a much lower MAPE of 1.3%, indicating a higher degree of accuracy. Given the general predictive power suggested by the MAPE, the Trend and Seasonal model should not be discarded, despite a non-significant ANOVA.

DISCUSSION

As was predicted, the lockdown had a severe effect on business activity as measured by electivity consumption in the commercial sector. Surprisingly, the rebound in sales volume for electivity was strong in the months of June and July, despite non-uniform easing of lockdown mandates. To explain the strong return to the model baseline, we propose that a recovery of activity in the commercial sector has mounted, at least in the months from May to July, inclusive. But, which types of activity?

Perhaps, shifting consumer behavior due to the lockdown measures has caused increases in electricity demand. Weekly technology and appliance usage habits during the lockdown, and their impact on power consumption would be an initial area of investigation. Another change is the second order effects of stimulus policy, such as the CARES Act, on businesses and households. Additionally, governments and utility companies may have instituted short-term emergency relief programs, ensuring universal access to power independent of payment delinquency. Finally, there is the prospect of an increased mobilization of business activity shifting demand for energy as firms attempt to front-run the recovery.

REFERENCES

Makridakis, S., Wheelwright, S.C. & Hyndman, R.J. (1998). *Forecasting: Methods and applications*, (3rd ed). New York: John Wiley and Sons.

Data Source: US Energy Information Agency - URL: https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_01

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A CASE STUDY OF THE CONTRIBUTION OF CERTAIN FINANCIAL MANAGMENET DECISIONS TO THE OVERCROWDING OF A PENNSYLVANIA PUBLIC SCHOOL DISTRICT

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ABSTRACT

This case study of the North Hills School District (NHSD) examines the challenges of financially managing a successful public-school district facing the common problem of overcrowding. With the opening of the 2020-21 school year, the district is in its ninth consecutive year of increased population. And for the next five years enrollment is predicted to increase, but before the recent surge, enrollment had declined for over a decade. (Department of Education, 2019). The paper assumes the instability of future student population, and instead focuses on the critical financial decisions that contributed to the overcrowding crisis, specifically the selling of three elementary school buildings and other real property. This chronicle has elements of a success story, but it also carries a warning regarding the virtually irreversible decisions of selling of school buildings: lost capacity is very hard to regain.

INTRODUCTION

Over the last two decades, Ross Township and Westview Borough, have emerged as thriving inner ring suburbs north of Pittsburgh. For instance, Money Magazine ranked Ross Township as the 48th best place to live in America (Money, 2020).

The school district for those two suburbs – the North Hills School District (NHSD) – has also achieved a laudable level of success over that time. In 2019, the Pittsburgh Business Times ranked NHSD as No. 12 among more than 100 western Pennsylvania school districts and No. 39 in the commonwealth (NHSD, 2019). Similarly, U.S. News & World Report placed NHSD in the top 11 percent of high schools in the nation (NHSD, 2019). Even with that quality of education in a state that relies heavily on property taxes to fund school districts, Ross and Westview have kept property tax rates among the lowest in the Pittsburgh metropolitan area (fourth lowest out of forty-five) due in part to higher-value commercial properties within the district (Wikipedia, 2020).

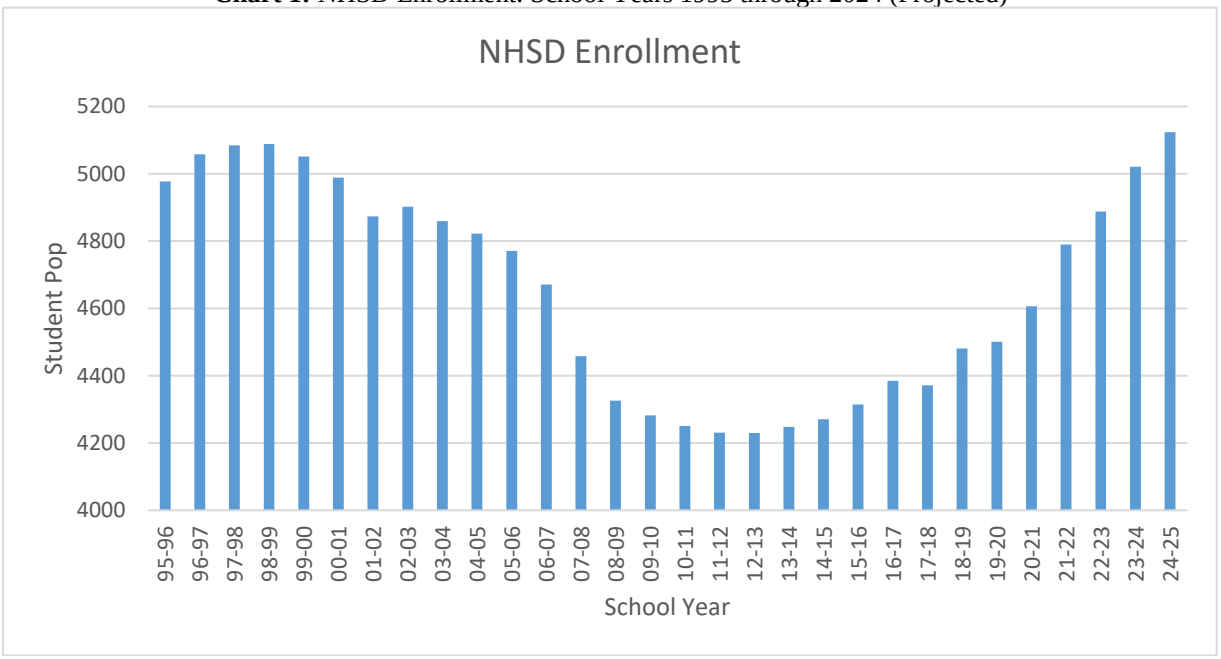
Despite those successes, NHSD has a problem, and it is a big one. Its elementary schools are overcrowded, and projections suggest that student populations will continue to increase. It is natural to suppose that overcrowding is the price for success: of course, good schools in affordable, thriving inner ring suburbs are in high demand.

On closer examination, however, this case study concludes that certain financial management decisions made by the NHSD over the past twenty years have contributed significantly to the overcrowding. Even worse, those same decisions have reduced NHSD's ability to adjust out of the overcrowding crisis, at least without substantial negative consequences in terms of cost, disruption, and/or long-term efficacy. Those financial management decisions over the past two decades have a common theme – the selling of school buildings. Although those sales resulted in financial gains (through cost avoidance and some revenue), the future for NHSD is not as sanguine owing to the present overcrowding crisis. The present burst in student population would have still presented challenges, but if NHSD had chosen to retain and maintain school buildings, then it would have one more option for responding to overcrowding – renovating an using one of its former schools. Currently, NHSD is contemplating several approaches to overcrowding, but it has no viable option for expanding capacity, and that provides a valuable perspective for other inner-ring school districts: once capacity is lost it cannot be easily regained. Before other school districts decide to go smaller and consolidate, they would be well served to account for the difficulties in rebuilding capacity that NHSD is currently experiencing.

STUDENT POPULATION, FACILITIES, AND PRESENT OVERCROWDING

Over the past twenty years, the student population for NHSD has dipped and risen again so that when represented by a bar graph, the period from 2000 to 2020 resembles a suspension bridge, see Chart 1, NHSD enrollment. The student population in 2000 was 4989, and that declined until 2012, when the population was 4230. The current population for the 2020 school year is 4606. According to NHSD's projections, enrollment will increase for the next four years up to 5124 in 2024-25 (NHSD, 2019).

Chart 1: NHSD Enrollment: School Years 1995 through 2024 (Projected)



Source: Department of Education 2019

NHSD's facilities have not maintained the same capacity over time. In 2000, NHSD consisted of nine schools: a high school (10-12), a middle school (7-9), and seven elementary schools (K-6). By 2020, NHSD had sold three schools and adjusted the grade levels that the remaining schools contained. It consists of six schools: a high school (9-12), a middle school (6-8), and four elementary schools (K-5) (NHSD, 2019). With the reduction in the number of school buildings, NHSD's student capacity declined from 2000 to 2020.

With an increased student population and reduced capacity, NHSD faces an overcrowding problem. The National Center for Education Statics (NCES) defines overcrowding in schools when "the number of students enrolled in the school is larger than the number of students the school was designed to accommodate." (NCES, 2000).

Overcrowding poses several problems, especially during the COVID crisis, but prominent among those is the negative impact of larger class size on student achievement for elementary school students. The consensus is that elementary school students learn more in smaller classes (Finn & Achilles, 1999; Nye, Hedges, & Konstantopoulos, 1999, 2002). Reducing class size tends to significantly improve test scores (Schanzenbach, 2010) and to generate substantial academic gains that are retained over time (Biddle and Berliner, 2002). Beyond improving student achievement, smaller class sizes result in greater student, teacher, and parent satisfaction (Schanzenbach, 2007). By contrast, class sizes above twenty students in the lower grades begin to see compromised student achievement (Word et al, 1990). Accordingly, several states have adopted class size limits to combat overcrowding. But even with the known benefits of smaller class sizes, to avoid overcrowding require a school's capacity to keep pace with increases in student enrollment.

As demonstrated by Chart 2, for the 2018-19 school year, NHSD's four elementary schools are overcrowded (using 22 students per classroom to calculate overcrowding). Nor do they have the capacity to adjust out of the overcrowding. Two schools (Highcliff and Ross) are operating at greater than 98% capacity, and a third (McIntyre) is operating at 93% capacity (NHSD, 2019). In 2018-19, one elementary school (Highcliff) reached its classroom capacity and is running 29 sections in 29 rooms with little to no space for student support programs. Another elementary school (Ross) is nearing its capacity with 30 sections in 31 rooms with limited space for student support programs (NHSD, 2019). One elementary school (Highcliff) has zero classrooms available. The remaining elementary schools do not have many classrooms available either: one school has one (Ross), another has three (McIntyre), and another has four (Ross). And for historical reference, the elementary student population for the 2018-19 school year is the highest since the 1997-98 school year, *when NHSD had an additional three elementary schools in operation* (NHSD, 2019).

Chart 2: Capacity at NHSD Schools

School	Classrooms Available	Classrooms Occupied	Enrollment	Capacity	Operational Percentage
High School	78	78	1311	1715	76.4%
Middle School	75	60	651	1650	39.5%
Highcliff	29	29	630	640	98.4%
McIntyre	34	31	697	750	92.9%
Ross	31	30	970	685	97.8%
West View	28	24	549	615	89.2%

Source: NHSD, 2019

Without the physical space for many more classes, one of NHSD's responses to the overcrowding has been to increase class sizes at the elementary schools. As shown by Chart 3, for 2018-19, the average class size in the elementary schools is 22.33 (Trozzo, 2019).

Chart 3: 2018-19 North Hills Elementary School District Enrollment

	Total Enrollment	Total Classes Occupied	Vacant Seats	Average Class size	No. of classrooms as built	No. of classrooms available
Highcliff	630	29	101	21.72	29	0
McIntyre	697	31	82	22.48	34	3
Ross	670	30	84	22.33	31	1
West View	549	24	55	22.88	28	4
Total	2546	114	322	22.33	122	8

Source: NHSD 2019

THE INABILITY TO ADJUST OUT OF OVERCROWDING

Because the student population is predicted to increase, the continued overcrowding jeopardizes NHSD's future academic success. Accordingly, NHSD has responded to the overcrowding in several ways. It has redistricted elementary borders for the 2016-17 school year, constructed a two-story addition at McIntyre Elementary in 2017-18, and relocated special education programs to different elementary buildings (NHSD, 2019). But those changes did not eliminate overcrowding.

In addition, in 2018, the NHSD Superintendent made clear that "this is a capacity issue, we're running out of capacity in three of our four elementary schools the sixth graders are to be moved out of the grade-school buildings and attend classes in the middle school building." (Trozzo, 2020). The NHSD Superintendent set forth several approaches for mitigating the overcrowding problem. Those options consisted of (1) redistricting elementary schools (for the third time in five years); (2) reconfiguring the four elementary schools into two K-2 schools and two 3-6 schools; (3) adding classroom space to the only elementary school (Ross) readily capable of further expansion and reestablishing the boundaries for that new school; (4) reducing full-day kindergarten to half-day kindergarten; (5) increase class size from an average of 22.3 to 24.25 students, but for some grades there would be as many as 30 students per class; or (6) reconfiguring the elementary schools to K-5 and the middle school to 6-8. NHSD opted for the last approach. (NHSD, 2019). But under current forecasts, that will preserve existing levels of overcrowding, and only until 2025.

And even that solution is faltering. With student population still rising in 2019, NHSD placed more students into already-existing classrooms. (NHSD, 2019). And in April 2020, NHSD placed a temporary, one-year override of class-size limitation. With that overrise, class sizes in certain K-3 classrooms to increase by two students (NHSD, 2020) – allowing class sizes of 25 students in K-1 and 27 students 2-3. At one elementary school those changes meant that a child in a third-grade class of 19 went to a fourth-grade class of 27. (Trozzo, 2019).

Notably absent from any of these options was the ability to substantially increase capacity. Only one elementary school could be expanded, and even with the increased capacity from that expansion, the overcrowding and class-size problems would persist (NHSD, 2019).

DECISIONS TO REDUCE CAPACITY

The present overcrowding has two primary causes: the increased student population and the reduced capacity of the schools. Student population is hard to predict reliably, especially for the long-term time-horizons that concern school districts. But capacity decisions must be made even with the challenge of accurately forecasting future student populations. And as detailed below, the critical decisions to reduce capacity. The first round of those decisions (to close three schools) was made in 2006, at a time when student populations were dropping and were predicted to continue to drop. But the second round of those decisions (to sell the three closed schools) took place in 2012 and 2016 – once it was clear that student populations were increasing and that an overcrowding problem was on the horizon.

NHSD started on the path to reduce capacity in 2006 – when it adopted a plan to close three elementary schools. At that time, NHSD's student population was in decline (down to 4671), and all the school buildings were old and in need of renovation. The renovation would be costly, especially because it would require compliance with the accessibility requirements of the Americans With Disabilities Act (Kurut, 2007). And thus, to cut costs, the NHSD decided to reduce capacity by closing three elementary schools. In the first full year after the school closings 2010, NHSD saved $1.7 million. That is not to say that NHSD did not have increased costs: it obligated about $53 million to renovate the remaining schools and expand three of the remaining elementary schools to accommodate the extra students at those schools (Barcousky, 2008). To finance those costs, NHSD had to take on $30 million in 24-year bonds (Barcousky, 2008).

The school closings and renovations were not without disruption to the student population. Three schools (McIntyre, Ross, and Westview) were re-districted, forcing students to attend new schools, and that came with bussing costs for the students who could previously walk to their school. (Kurut, 2010).

The school closings did not represent an irreversible loss in capacity: NHSD still owned those schools. It had to pay maintenance costs on those properties. And if it ever wanted to re-use those schools, it would incur substantial renovation costs to re-operate the schools.

But then in 2012, NHSD started to sell those three closed schools. NHSD sold the former Perrysville Elementary School building to the nonprofit Glen Montessori School for $630,000 in 2012. (Luna, 2012). That same year, NHSD sold the former Northway Elementary School along with its 6.65-acre property to a development company for $2.46 million (Tribune, 2012).

And later in 2016, once the prospect of overcrowding was quite real, NHSD declined to re-open the former Seville Elementary School (Larussa, 2016). Doing so was projected to between $8 million and $9 million, plus about $2.2 million more in annual operating costs (Larussa, 2016). Instead, in 2017, NHSD sold the vacant Seville Elementary School and the 9.3 acres upon which it sits to the Holy Family Institute for $445,000 (Larussa, 2017).

At the same time as NHSD was selling schools, it was taking dramatic other actions to address its rising student population. In 2016, NHSD redistricted elementary borders, again, to make room at two elementary schools where students exceeded capacity (Larussa, 2016). In 2017 due to overcrowding, NHSD built a two-story, eight classroom, 11,480-square foot addition to one school (McIntyre) for $2.4 million (Heyl, 2017).

CONCLUSION

Through increases in student population NHSD has an overcrowding problem. Based on decisions to sell three school buildings, NHSD lacks the ability to substantially increase capacity. Only one elementary school is capable of expansion (Ross); the others have either been expanded or cannot be expanded. And acquisition of a new building is not a viable option due to the unavailability of real estate in the thriving inner-ring suburbs of Ross Township and Westview Borough. Without a ready ability to substantially expand its capacity, NHSD's option to address overcrowding have diminished, and it now imperils its academic achievement through very large class sizes.

Had NHSD not sold all three school buildings, it would have other options for expanding capacity. That is not to say that NHSD did not have reasons to sell those schools. By selling those schools, it avoided maintenance costs, and it generated some revenue. And to make those schools operational, NHSD would have had to incur significant renovation costs. But with the schools now sold, NHSD has no viable option for expanding capacity. Once capacity is lost, it cannot be easily regained -- at least for the school district serving two thriving inner-ring suburbs. To avoid that same fate, other school districts would be well served to account for the difficulties in rebuilding capacity before they decide to go smaller and consolidate.

REFERENCES

Barcousky, L. (January 2008). Highcliff zoning variance rejected by Ross, *Pittsburgh Post-Gazette*.

Brown, A. (September, 2011). nhsd celebrates end of construction; Opens Ross Elementary. *Patch*.

Finn, J., & Achilles, C. (1999). Tennessee's class size study: Findings, implications, misconceptions. *Educational Evaluation and Policy Analysis, 21*(2), 97-109. Retrieved December 9, 2020, from http://www.jstor.org/stable/1164294

Heyl, E., (August, 2017). North Hills School District's McIntyre Elementary addition nearly complete. *Patch.*

Kurut, D. (December, 2008). Name sought for North Hills School. *Tribune.*

Kurut, D. (March, 2010). Vote nears on North Hills School Configuration. *Tribune.*

Kurut, D. (October, 2007). Zoning officials want firsthand look at North Hills renovation. *Tribune.*

Larussa. T. (November, 2016). North Hills students moved once could stay put under proposed change. *Pittsburgh Post-Gazette.*

Larussa, T. (January, 2016). North Hills Superintendent outlines another option for redistricting elementary schools. *The Tribune Review*. Retrieved from http://triblive.com/news/adminpage/9865590-74/students-district-grades

Larussa, T. (February, 2016). NH School Board decides not to consider additions or modular classrooms to ease overcrowding. *The Tribune Review*. Retrieved from http://triblive.com/news/adminpage/9996175-74/board-budget-elementary

Larussa, T. (January, 2016). 2 options off table in North Hills redistricting. *The Tribune Review*. Retrieved from http://triblive.com/news/adminpage/9798339-74/million-options-board

Larussa, T. (January, 2017). North Hills approves selling former Seville school to Holy Family Institute for $445K. *Tribune.*

Larussa, T. (2016, February 18). North Hills will abide by state-mandated taxing limit. *The Tribune Review*. Retrieved from http://triblive.com/news/neighborhoods/northhills/9873109-74/district-state-property.

Larussa, T. (September, 2020). Ross Township named to Money's best places to live in America list. *Tribune*.

Luna, T. (February, 2012). Glen Montessori School to gain space in move to Perrysville. *Pittsburgh Post-Gazette*.

Money, (September, 2020). Money's best places to live in America. https://money.com/collection/best-places-to-live-2020/5699650/ross-pennsylvania/

North Hills School District, (April, 2020). NHSD Board of Education approves proposed final budget for 2020-21. https://www.nhsd.net/protected/ArticleView.aspx?iid=6G03GAB&dasi=3P0Y

North Hills School District, (2020, June). About Us. https://www.nhsd.net/About.aspxNorth Hills School District, (June, 2016). https://www.nhsd.net/Downloads/FAQs%20-%2012-15-153.pdf

North Hills School Disctrict, (November, 2019), *Elementary Student Population Solutions*. https://www.nhsd.net/ElementaryStudentPopulationSolutions.aspx

North Hills School District, (2020, June). NHSD Board of Education approves proposed final budget for 2020-21 https://www.nhsd.net/protected/ArticleView.aspx?iid=6G03GAB&dasi=3P0Y

Nye, B., Hedges, L. V., & Konstantopoulos, S. (1999). The long-term effects of small classes: A five-year follow-up of the Tennessee class size experiment. *Educational Evaluation and Policy Analysis, 21*(2), 127–142.

Nye, B., Hedges, L. V., & Konstantopoulos, S. (2002). Do low-achieving students benefit more from small classes? Evidence from the Tennessee class size experiment. *Educational Evaluation and Policy Analysis, 24*(3), 201-217.

Pennsylvania State Data Center (2015). Retrieved from http://penndata.hbg.psu.edu/BSEReports/Public%20Reporting/2013_2014/PDF_Documents/Speced_Data_Report_SD052_Final.pdf

Ross Township, Allegheny County, Pennsylvania. (2019, December). *Wikipedia*. https://en.wikipedia.org/wiki/Ross_Township,_Allegheny_County,_Pennsylvania#Education

Schanzenbach, D. W. (2007). What have researchers learned from project STAR? *Brookings Paper on Education Policy*, 2007.

Shea (January, 2014). 5-Year contract for North Hills teachers called win for everyone. *The Tribune Review*. Retrieved from: http://triblive.com/news/allegheny/5458545-74/contract-agreement-teachers.

Snyder, K. (October, 2011). North Hills School Board moving ninth grade to high school. *Patch.*

Tribune. (December, 2012). North Hills School District files sale petition on former school. https://archive.triblive.com/news/north-hills-school-district-files-sale-petition-on-former-school/

Trozzo, S. (November, 2018) North Hills superintendent considers options for enrollment spike. *Pittsburgh Post.*

Trozzo, S. (September, 2019). North Hills running out of room for some elementary school students. *Pittsburgh Post-Gazette*

Trozzo, S. (May, 2020). North Hills school board budget to keep tax rate steady. *Pittsburgh Post-Gazette.*

U.S. Census Bureau. (2019, June). QuickFacts West View Borough, Pennsylvania; Ross Township, Allegheny County, Pennsylvania https://www.census.gov/quickfacts/fact/table/westviewboroughpennsylvania,rosstownshipalleghenycountypennsylvania/PST045219

Word, E. Johnston, J., Bain H.P., et al. (1990). Student/teacher achievement ration (STAR): Tennessee's K-3 class size study. *Final Summary Report 1985-1990. Nashville, TN: Tennessee State Department of Education.*

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A FRAMEWORK FOR THE QUALITATIVE COMPARISON OF SENTIMENT API SERVICE PROVIDERS

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ABSTRACT

This paper proposes a framework for the qualitative comparison of sentiment analysis API resources provided by the following visionary service providers: Amazon, IBM, Google, and Microsoft. Here, "visionary" is a designation assigned by Gartner, Inc. (Baker, Elliot, Sicular, Mullen, & Brethenoux, 2020). The intent of the investigator is to provide a general-purpose framework for the comparison of similar API resources provided by multiple vendors.

The acronym API is short for Application Programming Interface. APIs are software products that provide well-established, consistent means of communication between two computing resources.

The competing sentiment analysis processes described in this paper have been applied to a novel body of unstructured data: the responses to the last three questions posed by the institutionally administered student feedback forms for a subset of classes taught by the investigator over the past five years.

This approach allows for discussion of the differences between the service providers and has the novel side-benefit of illustrating how student sentiment towards a specific course in programming has changed over time.

Instructors of university level courses who seek to introduce API concepts and technologies into their classes, along with decision makers in MIS and related fields, will find this topic to be both practical and thought-provoking.

INTRODUCTION

Application Programming Interfaces, commonly referred to as APIs, are nothing new. The concepts behind APIs are, in fact, so commonplace today that most academics and technology professionals take them for granted. An API, in its purest sense, is a software product that facilitates communication between two computing resources. This facilitation is accomplished by implementing a set of programming conventions that can be used by one computing resource to manipulate the other in a predictable, consistent, and well-established way. APIs provide a very necessary layer of abstraction in any complex technical system. They allow software developers to treat foreign and/or remote computing resources as a "black box" and leverage those resources without knowledge of the mechanisms that are veiled behind the interface.

Originally, APIs were conceived of as a practical way to manipulate complex hardware devices (Cotton, I., & Greatorex, F., 1968). These types of APIs still exist and are now more properly called "device APIs". With the advancement of technology and telecommunications, the API concept was extended to solutions that exchange data between organizations, and with the rise of the Internet (and related standards) the "web API" came into existence.

Early proponents of these web APIs included Amazon, Salesforce, Facebook, and Twitter. In the early 2000's some industry analysts began to speak of the "API Economy" (Siriwardena P., 2020). And, while no one company can claim to have *exclusively* directed the technology trends of the last 20 years, many authors point to a memo to Amazon employees authored by Jeff Bezos in 2002 as a seminal moment in technology history (Stimmel, 2015). Since then, the "web API" has since become so predominant in industry that most uses of the term API (e.g. the "API Economy" and the "API Mandate") are, in fact, references to web APIs. For this reason, the term "API" will be used in lieu of "web API" for the rest of this paper.

Modern developers who are proficient in leveraging vendor-provided APIs now have (in an abundance unlike any other generation before) a vast array of capabilities available to them. Readily available APIs exist to provision and manage virtual servers; to manage image, video, and audio data; to process financial transactions; to process speech; to process facial recognition (or other biometric services); to send email and text messages; to provide authentication services; to develop chat-bots; to generate interactive maps; to solve route optimization problems; to encrypt/decrypt data; and … the list goes on. Every sophisticated and/or computationally challenging task can, with the correct API, be delegated to a (highly available, high capacity) remote resource for processing.

With such an extensive array of options available from multiple vendors, it would seem safe to presume that business leaders and decision makers would benefit from any framework that would allow them to differentiate between those vendors. This has been attempted in the past, with an emphasis on making selections by identifying the vendor who could provide the optimal Service Level Agreement (SLA). In this prior work we find the following statement: "[A] major challenge for a cloud customer is to select an appropriate service provider from the cloud marketplace to support its business needs. However, service guarantees provided by vendors through SLAs contain ambiguous clauses which makes the job of selecting an ideal provider even more difficult." (Ghosh, Ghosh, Das, 2015).

In another work of prior literature, we find evidence that suggests the reason for the aforementioned ambiguity. "We have shown in the first case that SPs (Service Providers) in the telecommunication networks have an interest in confusing customers, which means that the more customers are irrational, the SPs earn more." (Omar, Outanoute, Balsam, Fakir, & Bouikhalene, 2019). While telecommunications is broader, older industry than that of the API service providers, it seems rational to presume that competition has a similar effect on both industries.

Competition inevitably drives large technology companies that provide very similar API services, to attempt to differentiate themselves from their competitors and to discourage direct comparison. This leads to customer confusion.

That leads to the premise of this paper. It should be possible to create a *qualitative* framework to aid the consumer in the vendor selection process. By focusing on the qualitative attributes of a service that supplement quantitative measures (e.g. price, accuracy, and speed) the vendor selection process can be both improved and the impact of provider-induced confusion diminished.

To discover the qualitative attributes of this proposed framework a specific API service offering, sentiment analysis, provided by multiple vendors was evaluated. It was the investigator's expectation was that the APIs of all the evaluated vendors (e.g.service providers) would generate comparable quantitative accuracy, given the same set of data. It is this investigator's hope that the findings of this narrow examination of a specific kind of service (sentiment analysis) will result in observations and (ultimately) a framework applicable to the broad population of possible API services.

Sentiment analysis was chosen for this study because it is not clearly associated with any single, well known, technology company (in contrast, say, to Google Maps, or Amazon Alexa). It was also chosen for its simplicity.

Sentiment analysis is a subdiscipline within the field of Natural Language Processing (NLP), which in turn is a subdiscipline of Artificial Intelligence (AI). Sentiment analysis is the algorithmic analysis of unstructured text with the goal of determining the emotional disposition of the author. While there are many possible ways to describe an author's emotional disposition, a common practice in sentiment analysis is to award a numeric score to the text which, in turn, indicates that the author was, overall, "positive", "neutral" or "negative".

According to Gartner, Inc. the following four companies are designated as "visionary" leaders in providing Artificial Intelligence API resources to developers: Amazon Web Services, IBM, Google, and Microsoft (Baker et al, 2020). These four companies then were the focus of this analysis and will be hereafter referred to as the "Visionary Four" in this paper.

DATA AND METHODOLOGY

The Visionary Four can be quantitatively compared in terms of price, accuracy, and speed. For Amazon AWS, the specific API service used in this comparison has the brand name "Amazon Comprehend". The Microsoft Azure sentiment API product is called simply, "Text Analytics". The Google sentiment API service is known as the "Cloud Natural Language API" and the IBM product is called "Watson Natural Language Understanding".

Price

While pricing information is readily available from each provider, the comparison of price is not straightforward. Given the findings of prior literature this is not surprising, as service providers have incentive to discourage direct

comparison and introduce confusion (Omar et al, 2019). The differences in pricing structures will be detailed further in the following section.

Accuracy

To facilitate the comparison of accuracy, a data set was needed. The chosen data set was comprised of anonymous responses from students to three open-ended questions answered by 151 students, over a 5½ year (11-semester) period. The questions were part of the routine, institutionally administered, student feedback forms for a specific course taught be the investigator.

The three questions were:

1. What aspects of the course or the instructor's approach contributed most to your learning?
2. What aspects of the course or the instructor's approach would you change to improve the learning that takes place in the course?
3. Please comment on the instructor's sensitivity to the diversity (for example, political viewpoint, race, ethnicity, national origin, gender, sexual identity, and disability) of the students in the class.

To further facilitate comparison, the text data was provided to three undergraduate teaching assistants to review. Each student response was manually coded with a 1 (for a positive remark), a 0 (for a negative remark), or a 0.5 (for a mixed or neutral remark). The scores assigned by these human reviewers were then compiled and compared to the sentiment analysis results provided by the Visionary Four.

Each of the Visionary Four service providers offer free-tier options, an abundance of online documentation, and support for multiple programming languages. Node.js scripts were used to read the files containing the source data, call the relevant API, and return a sentiment score for each portion of response text. The resulting scores were stored in text files for further analysis.

These scripts (one for each of the Visionary Four providers), the source data files, and the resulting output can all be found at this location: https://github.com/JeremyShafer/sentiment-code-samples

Speed

These same scripts were also used to compare the speed of each API. It should be noted that the speed comparison performed in this study is based exclusively on the free-tier services offered by each provider, and that some providers deliberately "throttle" the processing of requests that originate from non-paying customers.

EMPIRICAL RESULTS

As stated in the previous section, the Visionary Four were compared using the quantifiable metrics of price, accuracy, and speed.

A Comparison of Price

The comparison of price is not straightforward, as each provider attempts to differentiate themselves and attract to different consumer audiences with a unique, and potentially confusing, pricing structures.

Here are the findings of that investigation. In the following exhibit no effort has been made to simply the units or categorizations used by the vendors.

Amazon AWS

Less than 20 units per second and under 50k units	Free
Up to 10M units	$0.0001
From 10M-50M units	$0.00005
Over 50M units	$0.000025

Google Cloud

0 - 5K units	Free
5K+ - 1M units	$1.00 per 1000 units
1M+ - 5M units	$0.50 per 1000 units
5M+ - 20M units	$0.25 per 1000 units

IBM Watson

30,000 NLU Items Per Month	Free
1 - 250,000	$0.003 USD/NLU Item *
250,001 - 5,000,000	$0.001 USD/NLU Item *
5,000,000+	$0.0002 USD/NLU Item *

* plus $800.00 USD/Custom Model Instance per Month

Microsoft Azure

5k transactions free per month	Free
0-500,000 text records	$2 per 1,000 text records
0.5M-2.5M text records	$1 per 1,000 text records
2.5M-10.0M text records	$0.50 per 1,000 text records

Additional higher performance options were available as well

Exhibit 1 – Varied Pricing Structures

To enable comparison, the investigator considered the "per unit" costs of analyzing text at a rate of 10M units a month. Here, the reader will understand that a "unit" is a piece of text provided by a user. It could be an email, a tweet, a product review, or (as in this paper) a piece of student feedback.

The results are summarized in the following table.

Comparison of Cost at 10M Units a Month				
Provider:	AWS	Azure	Google	IBM
Cost per unit:	$0.00010	$0.00025	$0.00025	$0.00020

Table 1. Comparison of Cost at 10M Sentiment Analysis Units a Month

This, of course, is based exclusively on publicly available pricing data, and does not take in to account any academic pricing, government pricing, or any other such special arrangement.

A Comparison of Accuracy

As expected, the differences in the sentiment analysis results generated by the Visionary Four where largely unremarkable. The following diagrams depict the average sentiment scores along with an indication of dispersion (one standard deviation) for each of the three questions. Note that the results of the sentiment scoring conducted by humans is represented as well, for the sake of comparison.

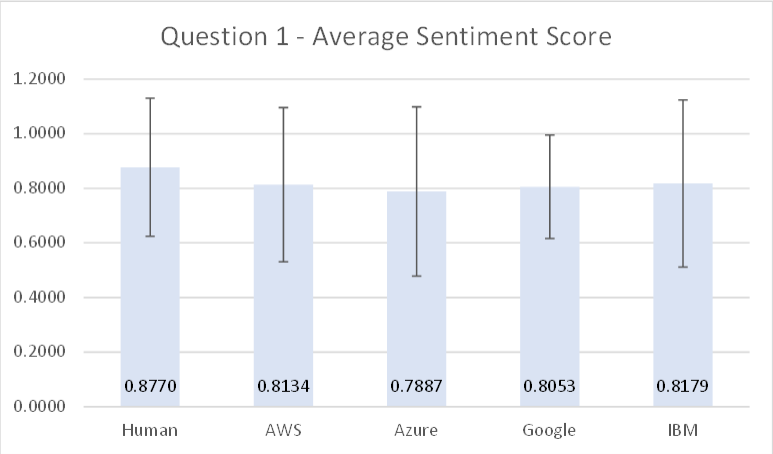

Figure 1. Sentiment scores derived from question 1 text

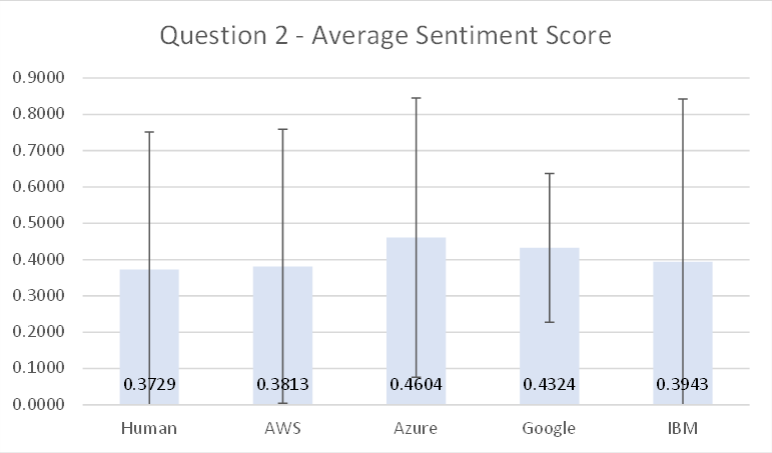

Figure 2. Sentiment scores derived from question 1 text

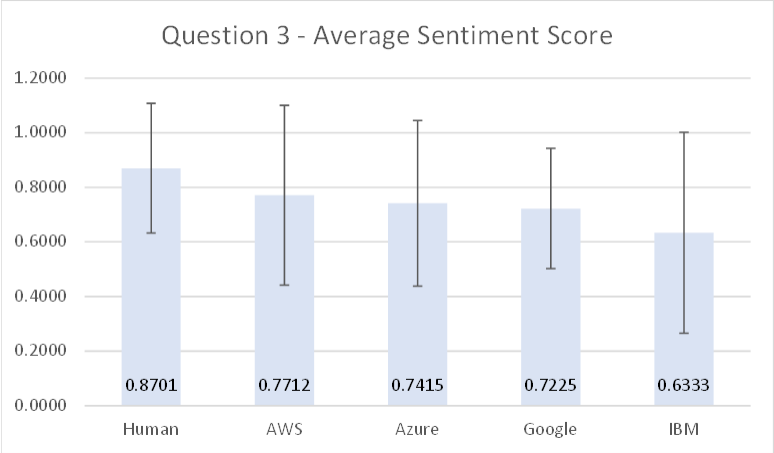

Figure 3. Sentiment scores derived from question 1 text

As can be seen here, each of the three questions elicited different sorts of responses from the students. The first question invited students to remark on how the course content and instructor influenced their learning. This question elicited largely positive remarks. Students also tended to provide the most text to this question.

The second question invited students to critique the course and offer suggestions for improvements. This elicited responses that were more likely to be considered negative by human and machine reviewers alike. Fewer students responded to this question.

Finally, the third question invited students to comment on the instructors "sensitivity to diversity" and was very likely to elicit short or incomplete answers such as "no problems". Human reviewers accounted for the context of the question and often scored such short answers as positive, whereas the machine reviewers were limited to algorithmic assessment of the text.

In the above illustrations, the results generated by the Google API appear to have less dispersion. This is misleading. The Amazon, Microsoft, and IBM APIs all offered the option to generate a categorical result representing the sentiment of the text (i.e. "positive", "negative", or "neutral"). The Google API did not offer such a feature. Instead, the Google API returned (only) a numeric score, which the investigator then translated in to the 0 to 1 scale used in this analysis. Further refinement the Google-provided output would have required the investigator to make inferences relevant to the range of values necessary to apply the categorical designation. This would have then required the investigator to apply still more refinement to the Google-generated data that was not applied to the other Visionary Four providers. The nature of this paper requires that the sentiment results generated by the Visionary Four providers be compared in a manner that is as direct and unbiased as possible. Thus, an additional level of refinement applied to one provider, but not the others, seemed ill-advised.

Similarly, the IBM Watson API appears to generate results with a greater level of dispersion than those results generated by IBM's competitors. The reason for this discrepancy is that the IBM-provided API took a distinctly different approach to managing very short pieces of text. If given a very short piece of text (say, a single letter "A" or a short one or two word statement such as "OK" or "no problems") the IBM Watson API would fail to return a sentiment score, and would instead report an error stating "Unprocessable Entity: not enough text for language id" whereas the competing APIs would attempt to return an indication of "neutral" text. Consequently, the population of scores generated by the IBM service was smaller and also possessed fewer scores of 0.5.

The use of sentiment analysis to evaluate unstructured student feedback may be of particular interest to readers considering the application of sentiment analysis in the context of higher education administration. Those readers are encouraged to consult Appendix B of this paper.

A Comparison of Speed

As previously stated, this paper's investigation was limited to the use of free-tier services, and consequently the commercial speeds of the APIs in this paper were not assessed. Three out of the four vendors considered imposed arbitrary rate limitations on their API, with Microsoft's Azure product being the most restrictive.

Despite this, an attempt was made to assess the speed of each provider. The results are shown here.

Comparison of Speed				
Provider:	AWS	Azure	Google	IBM
Max Speed per unit:	0.1 second	1.0 second	.001 second	.01 second

Table 2. Comparison of Speed

Commercial capacities should not be inferred from these results. The differences shown here may be reasonable restrictions imposed on non-paying customers, or a deliberate attempt by the vendors to discourage meaningful comparison, or they may represent true differences in underlying technical efficiencies, or some combination of those things.

A PROPOSED FRAMEWORK

Certainly, the quantitative considerations of cost, accuracy, and speed are important. However, prior research (Omar et al, 2019) and the results of this paper's investigation suggest that information regarding differences in cost and speed may be deliberately confused, thereby diminishing the prospective customers ability to make direct comparisons. Differences in accuracy were observable, and measurable. However, the variance in the data relative to each API's output was great. Direct comparison of the vendors based on a quantifiable measure of accuracy was (again) problematic for that reason.

To aid business leaders and decision makers, the following decision-making framework questionnaire is proposed. This questionnaire would provide a vehicle for individuals within a business or organization to provide a qualitative assessment of an API provider. This questionnaire would be completed for each prospective vendor, thus enabling a level of comparison and contrast not otherwise available and (at least potentially) providing a catalyst for robust conversation about the merits and drawbacks of each provider.

Please note that the framework does not exclude quantitative considerations. It does, however, place the qualitative comparison of the service providers first in the decision-making process.

Service Provider Assessment Questionnaire

			Questions	Score (1 = strongly disagree, 3 = neutral, 5 = strongly agree)
Subjective Measures (S)	Business Leadership	1	Organizational "fit"	
		a	The (existing and/or proposed) Service Level Agreements of the provider are acceptable.	
		b	Our preferred programming langauge supported.	
		2	Market Position	
		a	The provider a known leader in the domain of the service.	
	Technology Leadership	3	Results of proof of concept (POC) investigation	
		a	POC code demonstrated acceptable functionality and performance.	
		b	The documentation is of sufficient quality for its envisioned use.	
		c	The API's authentication mechanisms can be easily supported in our implementation.	
		d	The API respond adequately to exceptional / incorrect data.	
		e	Switching costs can be minimized.	
Objective Measures (O)	Market Research	4	Quantitative Considerations	
		a	Acceptable Price (as advertised)	
		b	Acceptable Accuracy (as advertised)	
		c	Acceptable Speed (as advertised)	

Figure 4. A Service Provider Assessment Questionnaire

In the figure above, questions in categories 1 and 2 would be addressed by Business Leadership. These individuals are decision-makers with insight into the organizational structure but minimal technical skill.

Questions in category 3 would be best addressed by Technology Leadership. Technical Leadership refers to individuals within the organization that are be capable of writing simple "proof of concept" scripts similar to those used in this paper. It is only in this "proof of concept" process that the capabilities and limitations of an API be truly determined. Other discovery processes leave all decision-makers relying on second-hand information and marketing information.

Individuals responding to the questions in category 4 would be persons in an organization's purchasing or procurement department.

In large organizations, the responses to the survey questions could be aggregated from multiple respondents. For example, four developers could be assigned the task of developing proof-of-concept scripts independently, and their responses relevant to the quality of the APIs documentation could be averaged into a single numeric response to that question (e.g. 4.5).

With this questionnaire in hand, an organization's selection process for an API service provider could be sequenced as follows.

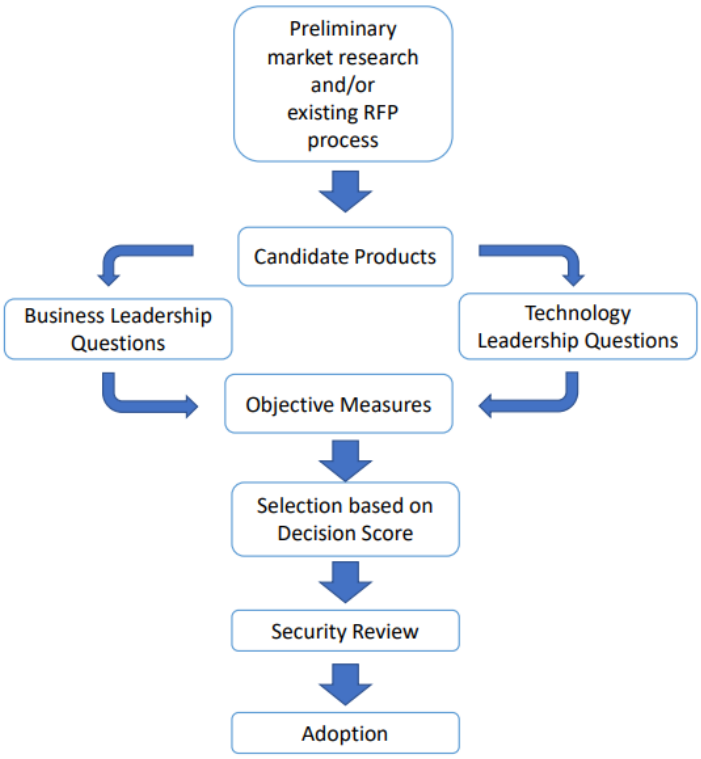

Figure 5. Proposed Selection Sequence

To facilitate the joint decision a quality score for each candidate provider could be assigned according to the formula:

$$\frac{\bar{O} + \bar{S}}{10}$$

In this formula, $\bar{O}$ represents the mean of the objective question score, and $\bar{S}$ represents the mean subjective question score. The resulting quality scores would range from 0 to 1, with the highest score representing the most desirable API provider.

Referring back to the questionnaire, the subject of question 3a has already been explored. In the following portion of this paper, we will use explore questions 3b through 3e of the questionnaire to discuss the differences observed in the Visionary Four. These four questions represent the qualitative differences in the API services.

QUALITATIVE COMPARISON

Two notable qualitative differences between our Visionary Four providers have already been mentioned: IBM Watson API's treatment of short /incomplete text, and Google's numeric-only scoring results. These are representative of qualitative differences that could have substantial bearing on an APIs suitability for a production environment. These differences could easily be disregarded by decision makers who focus exclusively on price per unit, accuracy, and speed.

Using the proposed framework, these and other important qualitative differences would be revealed early in the selection process. The qualitative evaluation of the Visionary Four providers revealed notable differences in documentation quality (3b), authentication mechanisms (3c), the management of data exceptions (3d), and actions necessary to minimize switching cost (3e).

Documentation (3b)

Each provider's evaluation began with a simple Google search, as in "how to perform a sentiment analysis with AWS". For AWS, the initial search brought the investigator first to a lengthy overview of sentiment analysis in general, and multiple options for conducting such an analysis with Amazon Comprehend. This, in turn, led to a "Getting Started Using the Amazon Comprehend API" document which implied that a CLI (Command Line Interface) would be needed. This ultimately proved to be incorrect, and the investigator later found a page containing the necessary code samples, and information relevant to Node.js. The subjective experience of the investigator was that the AWS documentation was convoluted.

This experience is in stark contrast to the Microsoft Azure documentation which led the investigator through a logical sequence of five web pages, which quickly led to the necessary code samples and documentation.

The discovery of the Google Cloud documentation was similarly efficient. However, extra investigation was required to determine the correct authentication mechanism. (This is described further in the next section.)

The investigator observed that the IBM Watson documentation was found after following a trail of only four web pages, however that was after the "false start" of exploring a similar NLP product offered by IBM.

The goal of this summary is not to posit which of the Visionary Four conclusively has the best documentation, but to rather underscore the challenges of navigating unfamiliar documentation resources.

If an organization's technical leadership consistently finds a provider's documentation unwieldy it is a noteworthy qualitative difference. Unwieldy documentation can potentially hamper employee problem solving ability, and productivity as well as potentially increasing dependence on external consulting services.

Authentication (3c)

Each of the API providers required subtly different authentication parameters. The authentication credentials offered by the free-tier AWS API required renewal every 3 hours. In contrast the credentials required by the other providers did not expire over the duration of this paper's research.

The Google authentication credentials needed to be stored as environment variables in the system hosting the script. This approach could be straight-forward for organizations where the roles of developers and system administrators overlap. But for organizations with more rigidly defined roles, this could create scenarios where a routine credential update would necessitate the involvement of multiple teams.

The Microsoft Azure and IBM Watson authentication processes were straight-forward. They could easily be managed by any authorized individual in an organization's technical team.

Data Exceptions (3d)

Organizations choosing between API vendors should anticipate error conditions that are likely to occur, and then test each candidate provider with those errors.

The IBM API's less-than-desirable treatment of short portions of text has already been described, and that is a good example of the kind of exception that should be proactively assessed by a business or organization.

Of additional note, the Google Cloud API demonstrated the admirable practice of reporting detailed error messages which also include URL references to related remediation tasks. This would be a great benefit to any organization which was rapidly evolving or prototyping a solution using a Google Cloud API. Again, this qualitative difference is not immediately reflected in any sort of empirical measure.

Switching Costs (3e)

The Visionary Four providers all return objects which contain varying levels of detail. Sample output from each of the vendors is shown below.

Amazon AWS

```
{ Sentiment: 'POSITIVE',
  SentimentScore:
   { Positive: 0.9941402077674866,
     Negative: 0.00020111893113609403,
     Neutral: 0.00564816826954484,
     Mixed: 0.00000141573502787650 8 } }
```

Microsoft Azure

```
[ { id: '0',
    statistics: undefined,
    warnings: [],
    sentiment: 'positive',
    confidenceScores: { positive: 0.93, neutral: 0.06, negative: 0.01 },
    sentences:
     [ { text: 'I like shafer.',
         sentiment: 'positive',
         confidenceScores: { positive: 0.87, neutral: 0.12, negative: 0.01 },
         offset: 0,
         length: 14 },
       { text: 'I think his class is great.',
         sentiment: 'positive',
         confidenceScores: { positive: 1, neutral: 0, negative: 0 },
         offset: 16,
         length: 27 } ] },
  statistics: undefined,
  modelVersion: '2020-04-01' ]
```

IBM Watson

```
{ usage:
        { text_units: 1,
        text_characters: 43,
        features: 1 },
  sentiment:
        { document:
                { score: 0.968931,
                label: 'positive' } },
  language: 'en' }
```

Google Cloud

```
{ sentences:
   [ { text: { content: 'I like shafer.', beginOffset: -1 },
       sentiment: { magnitude: 0.8999999761581421, score: 0.8999999761581421 } },
     { text: { content: 'I think his class is great.', beginOffset: -1 },
       sentiment: { magnitude: 0.8999999761581421, score: 0.8999999761581421 } } ],
  documentSentiment: { magnitude: 1.899999976158142, score: 0.8999999761581421 },
  language: 'en' }
```

Exhibit 2 – Object structures returned by API sentiment providers

From the above examples, it is evident that an organization that relies heavily on features beyond a simple categorization of sentiment could easily become "locked in" to one vendor or another. For example: the Google and Microsoft APIs both provide sentence-level analysis in addition to over-all sentiment. That would imply that, for organizations that relied on that sentence level analysis, the switching cost between Google and Microsoft would be relatively low, while the costs of switching to another provider (without that feature) would be high.

Similarly, the Amazon API gives a convenient breakdown of sentiment scores, and also draws a distinction between "Neutral" and "Mixed" sentiment. Replicating that output using any other vendor described here would require additional coding, and additional API calls to other services.

Likewise, the IBM and Google APIs incorporate the element of language detection in their evaluations. It isn't hard to image that some organizations might find that feature attractive. However, those organizations should understand that moving from an API with that language detection feature to an API without it would necessitate the investment of money and time to make all the related technical changes, as well as potentially incurring additional costs related to making a second call to another API dedicated exclusively to language detection.

In summary, heavy commitment to one specialized API feature or a unique combination of features creates "lock in" and raises the cost of switching to an alternate API provider.

Using the proposed framework requires an organization's technical leadership to survey all prospective vendors with simple "proof-of-concept" code. This practice affords the opportunity for these nuanced differences to be identified and considered early in the vendor selection process.

CONCLUSION

In this paper a framework was proposed to help business and organization decision-makers effectively choose between competing API service providers of comparable quality.

The need for this framework was evidenced by a futile attempt to identify objective, quantifiable differences between four visionary providers of a sentiment analysis API.

The differences in cost and speed were not readily comparable due to the practices and pricing policies of each provider. This is in keeping with the findings of prior literature which suggest that competitors have an incentive to introduce confusion to discourage straightforward comparisons such as these (Omar et al, 2019).

The differences in the accuracy of each provider were shown to be minimal. The variances in the resulting data were so great that it was difficult to conclusively proclaim one API provider as more accurate than another.

Consequently, to aid decision makers in businesses and organizations, a decision-making framework was introduced that included a questionnaire and a vendor selection sequence. The questionnaire provides a vehicle for business leadership, technology leadership, and the purchasing/procurement departments in an organization to award each competing vendor a score based on the combination of subjective findings and objective measures.

Some recommendations for further investigation and/or improvement are as follows:

1. Field testing and evaluation of the proposed framework. Using the proposed framework as a consulting tool would allow for validation (and refinement) of the framework over time.

2. Refinement of the questionnaire. The questionnaire presented here is the vehicle for different stakeholders within the organization to express their subjective opinions and objective findings. With further testing and evaluation, the questionnaire is expected to evolve, with new (and as yet unforeseen) subjective measures of quality.

3. Crowd sourcing of POC scripts. An open, publicly accessible repository of proof-of-concept scripts (similar to those written for this study) would lower the technical burden on an organization's technical leadership and further streamline the evaluation process.

Finally, the data set used was a population of responses to a routine survey of student satisfaction for a particular undergraduate course. Further consideration of this novel application of sentiment analysis is found in Appendix B.

REFERENCES

Amazon Comprehend – Pricing. (2020). Retrieved October 13, 2020, from https://aws.amazon.com/comprehend/pricing/

Baker, V., Elliot, B., Sicular, S., Mullen, A., & Brethenoux, E. (2020). Magic quadrant for cloud AI developer services. Retrieved October 11, 2020, from https://www.gartner.com/document/3981253?ref=lib

Benzell, Seth and Lagarda, Guillermo and Van Alstyne, Marshall W. (2017), *The impact of APIs in firm performance*. Boston University Questrom School of Business Research Paper No. 2843326, Available at SSRN: https://ssrn.com/abstract=2843326 or http://dx.doi.org/10.2139/ssrn.2843326

Carol L. Stimmel (2015). *Building the foundation for data analytics* EDPACS, 52(1), 1-13.

Cotton, I., & Greatorex, F. (1968). Data structures and techniques for remote computer graphics. In *Proceedings of the December 9-11, 1968, Fall Joint Computer Conference, Part I* (pp. 533–544). Association for Computing Machinery.

Ghosh, N. &, Ghosh, S. K., & Das, S. K. (2015). SelCSP: *A framework to facilitate selection of cloud service providers* IEEE Transactions on Cloud Computing, *3*(1), 66-79.

Natural Language Understanding – IBM Cloud. (2020, October 5). Retrieved October 13, 2020, from https://cloud.ibm.com/catalog/services/natural-language-understanding

Omar, D., Outanoute, M., Baslam, M., Fakir, M., & Bouikhalene, B. (2019). On understanding price-QoS war for competitive market and confused consumers. *Computing, Archives for Informatics and Numerical Computation*, *101*(9), 1327-1348.

Pricing – Cloud Natural Language API – Google Cloud. (2020). Retrieved October 13, 2020, from https://cloud.google.com/natural-language/pricing

Pricing – Text Analytics API: Microsoft Azure. (2020). Retrieved October 13, 2020, from https://azure.microsoft.com/en-us/pricing/details/cognitive-services/text-analytics/

Puder, A., Tillmann, N., & Moskal, M. (2014). Exposing native device APIs to web apps. In *Proceedings of the 1st International Conference on Mobile Software Engineering and Systems* (pp. 18–26). Association for Computing Machinery.

Siriwardena P. (2020) *APIs rule! in*: *Advanced API security*. Apress, Berkeley, CA. https://doi.org/10.1007/978-1-4842-2050-4_1

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APPENDIX A

The following has become known as Amazon's "API Mandate" (Benzel et al., 2017).

- All teams will henceforth expose their data and functionality through service interfaces.
- Teams must communicate with each other through these interfaces.
- There will be no other form of interprocess communication allowed: no direct linking, no direct reads of another team's data store, no shared-memory model, no back-doors whatsoever. The only communication allowed is via service interface calls over the network.
- It doesn't matter what technology they use. HTTP, Corba, Pubsub, custom protocols – doesn't matter. Bezos doesn't care.
- All service interfaces, without exception, must be designed from the ground up to be externalizable. That is to say, the team must plan and design to be able to expose the interface to developers in the outside world. No exceptions.

Anyone who doesn't do this will be fired. Thank you; have a nice day!

--Jeff Bezos, 2002

APPENDIX B

In the fall semester of 2019, a substantial rewrite of the course evaluated in this paper's dataset was launched. Significant changes included new and revised learning objectives, along with notable changes to the technologies used in the classroom. With the sentiment scores generated by the API service providers, it was possible to compare the average sentiment scores before, and after the course rewrite.

Using data generated by the Amazon Comprehend API, a *t* test was conducted to determine if the students' sentiment towards the instructor, as represented by question 1, changed.

Here are the results:

Group	Q1 before rewrite	Q1 after rewrite
Mean	0.780	0.878
SD	0.308	0.217
SEM	0.032	0.031
N	93	49

Table 3. Evaluation of Amazon Comprehend Sentiment Scores

Question 1 (blank responses excluded)

The resulting two-tailed P value equals 0.0496. By conventional criteria, this difference is considered to be statistically significant. While it would be incorrect to assume that this finding implied that the rewrite was the cause of the improved sentiment score, it is safe to conclude that student sentiment is improving over time.
The same treatment was applied to questions 2 and 3. The differences in question 2 and 3 sentiment scores before and after the course rewrite are not statistically significant by any conventional criteria.

Group	Q2 before rewrite	Q2 after rewrite
Mean	0.378	0.389
SD	0.379	0.383
SEM	0.039	0.057
N	94	45

Table 4. Evaluation of Amazon Comprehend Sentiment Scores

Question 2 (blank responses excluded)

In table 4 above, the two-tailed P value equaled 0.8708.

Group	Q3 before rewrite	Q3 after rewrite
Mean	0.779	0.756
SD	0.339	0.319
SEM	0.039	0.050
N	77	41

Table 5. Evaluation of Amazon Comprehend Sentiment Scores

Question 3 (blank responses excluded)

In table 5 above, the two-tailed P value equaled 0.7195.

This one specific example (student sentiment, before and after course rewrite) is representative of how sentiment scores could be used to evaluate student feedback in similar contexts. Many other such analyses are possible.

Sentiment results could be grouped by instructor, course, department, or college and reported at regular intervals. This practice could potentially be a valuable supplement to existing measures of academic quality (peer reviews, grades, standardized test scores, etc.)

UNDERGRADUATE BUSINESS STUDENT PREFERENCES IN EMERGENCY REMOTE TEACHING DURING THE COVID-19 PANDEMIC

Matt Shatzkin, York College of Pennsylvania

ABSTRACT

Emergency Remote Teaching, the act of teaching at a distance during a crisis, is a less studied field than traditional remote or online learning. However, during the Coronavirus (COVID-19) outbreak in March 2020, many colleges and universities physically closed and implemented Emergency Remote Teaching to continue the spring semester. As the practice of Emergency Remote Teaching will continue in varying degrees throughout the COVID-19 pandemic, it is valuable to understand the preferences and needs of students in order to deliver effective education. With this in mind, undergraduate students at Graham School of Business, York College of Pennsylvania were surveyed on their preference of Emergency Remote Teaching delivery method and frequency of virtual sessions. For the combination of flexibility and support provided, the preponderance of students preferred hybrid methods, which combined traditional online methods of asynchronous and synchronous delivery. For similar reasons, the students preferred a moderate amount of virtual sessions, as opposed to virtual sessions for all classes, or none at all. These preferences were found to be both statistically significant and unaffected by the independent variables of working or the volume of classes taken. At the same time, these preferences were found to be somewhat disconnected with the methods of delivery provided by the respective instructors. Overall, this study builds upon previous research in the field of Emergency Remote Teaching which reflects the student preference for a combination of flexibility and support. Furthermore, it provides relevant insight into the ongoing practice of Emergency Remote Teaching and provides areas for future study that may contribute to improving the efficacy of this necessary practice as the COVID-19 pandemic continues.

INTRODUCTION

In March 2020, similar to many other institutions across the world, educators at the York College of Pennsylvania were directed to move their face-to-face undergraduate courses into an online format due to the growing COVID-19 threat. As the campus was rapidly closed, instructors had to make quick decisions on how to continue their courses.

As York College was in a transition year between Moodle and Canvas learning management systems, the institution was starting with a foundation of internet-centered educational content. Additionally, in the days leading up to campus closing, all instructors had access to Zoom capabilities, which enabled virtual sessions and stand-alone recordings.

With these resources in place, instructors took different approaches towards continuing their courses. Some instructors implemented more of an asynchronous method, resembling more of a traditional approach to a conventional online course. With this method, content was on-line, for the student to complete at their own pace and time. This content may have included pre-recorded videos for students to view. Somewhat in contrast, other instructors chose more of a synchronous method, attempting to replicate the regularity and structure of the face-to-face experience. Within this method, classes were conducted virtually through the internet, through Zoom and other virtual interactive platforms, potentially during the times classes would have otherwise occurred if conducted in a resident fashion. Finally, other instructors adopted a 'blending' of the two methods, teaching portions of their courses both asynchronously and synchronously.

LITERATURE REVIEW

There is much published research that not only defines the field of online learning, but also captures the more effective practices within the field, to include student preferences for techniques of teaching and delivery. The leading model is the Community of Inquiry (CoI), with outlines the "presences" of online learning: cognitive, teaching and social (Garrison, 2008). Other methods that have been found to be effective in online learning have been constructivism, experiential and active learning, and developing an online community (Serrano et. al, 2019; Jones; 2011). The efficacy of recorded video in on-line learning has found to be strongly dependent on student motivation (Panferov, 2020).

In terms of methods of delivery, traditional modalities have divided into synchronous and asynchronous categories (Gautsch and Brown, 2010). With synchronous methods, all online students are in the same virtual place at the same time; with asynchronous methods, students perform work at their own pace and choosing (Jones, 2011).

The literature has made some distinction between traditional online learning and learning conducted under emergency conditions (Czerniewicz et. al, 2019). The latter has been referred to as 'resilient blended learning' (Mackey et al, 2012), and most recently, in response to COVID-19, "Emergency Remote Teaching" (Hodges et al., 2020). Whereas online learning provides options when physical attendance is not possible due to convenience or proximity, Emergency Remote Teaching provides access to education in situations where physical attendance is not possible due to crisis (Quinn, 2011). Other critical differences between online learning and Emergency Remote Teaching are the amount of time educators may have to prepare, implement, or adjust strategies (Mackey et. al, 2012). Emergency Remote Teaching situations are also distinct in terms of different expectations of students and rapidly changing environments (Czerniewicz et. al, 2019).

In contrast to the body of literature on conventional online learning, pre-COVID-19 research on higher education Emergency Remote Teaching methods during crises is relatively scarce and has been described as "scattered" (Mackey et. al, 2012). The existing work centers around two main sets of crises: earthquakes in New Zealand and the University of Canterbury's subsequent actions (Breeze et al, 2011; Mackey et al, 2012; Tull, 2017), and more recently, the University of Cape Town in South Africa's actions during disruptive political protests in 2017 (Czerniewicz et. al, 2019).

In both instances, the research centers around feedback gained from educators. Student preferences, when discussed, stem largely from educator observations of students during Emergency Remote Teaching. Within both situations, given the little time to prepare, methods of delivery varied widely from asynchronous and synchronous methods of delivery. While educators felt that students initially appreciated the flexibility that asynchronous methods provide, educators also maintained that many students were not prepared for the accountability and independence that is inherent to asynchronous methods. Specifically, instructors interviewed did not feel students could remain focused during pre-recorded, asynchronous video content. As a result, both studies highlighted an overall preference for face-to-face instruction, the need for interaction, connection and sense of community (Mackey et. Al, 2012; Czerniewicz et. al, 2019). Notably, while studies on the Universities of Canterbury and Cape Town involved undergraduate education, neither exclusively focused on business students.

HYPOTHESIS AND RESEARCH QUESTIONS

This study continues where previous literature ends, by analyzing student preferences within Emergency Remote Teaching during the Spring 2020 outbreak of COVID-19 and the subsequent closing of York College of Pennsylvania. In contrast to previous research, this study focuses on student perspectives gained directly from the students themselves. For this study, Hodges' definition of Emergency Remote Teaching (ERT) (2020) was used to refer to continuing higher education during the outbreak. The intent of this study is to examine the distribution of asynchronous, synchronous and hybrid methods used, along with the students' preferences for method of delivery and the frequency of virtual sessions.

Overall, the hypothesis is that the findings will follow those of previous studies; specifically, that undergraduate business students participating in Emergency Remote Teaching will prefer courses taught using hybrid methods more than purely asynchronous or synchronous methods:

H_O: # preferences for hybrid = # preferences for asynchronous = # preferences for synchronous
$H_{1:}$ # preferences for hybrid > # preferences for asynchronous, # preferences for synchronous

A complementary hypothesis is that undergraduate business students will prefer virtual sessions used for some of the course sessions, as opposed to the majority or none. The basis for this hypothesis comes from previous study findings in which students preferred some flexibility in Emergency Remote Teaching, but also desired some structure, contact and community throughout the crisis.

H_O: # preferences for some virtual sessions = # preferences for majority of virtual sessions = # preferences for no virtual sessions
$H_{1:}$ # preferences for some virtual sessions > # preferences for majority of virtual sessions, # preferences for no virtual sessions

Two additional areas of interest not addressed in previous studies were the impact of student course loads (amount of credits taken during the Spring 2020 semester) and working a job while in school on overall Emergency Remote preferences.

With these hypotheses and areas of interest in mind, the following research questions were developed:

1. As described by students, what was the distribution of delivery methods used by instructors?
2. What method (asynchronous, synchronous or hybrid) did undergraduate students prefer, and why?
3. What was the students' preference on the frequency of virtual sessions?
4. Do the findings differ with student course loads?
5. Do the findings differ between working and non-working students?

METHOD

Undergraduate students within York College of Pennsylvania's Graham School of Business were asked to take an online survey which was sent three weeks following the Spring 2020 semester. Within the survey, students were first provided a brief definition of ERT, along with short descriptions of asynchronous, synchronous and hybrid methods. The definitions of ERT and the respective students provided to students are listed in Figure 1.

Figure 1: *Definitions of ERT and methods of delivery provided to students taking the survey*.

During the semester of Spring 2020, in response to COVID19 distancing requirements, York College of Pennsylvania (YCP) conducted what is now called "Emergency Remote Education." As such, this survey will refer to Emergency Remote Teaching (ERT) in its questions. Please note that the questions refer to all of your YCP courses during the Spring 2020 semester. *For the purpose of this survey, please respond to the following Emergency Remote Teaching (ERT) methods of instruction:*

Asynchronous: a method in which content is posted online, for students to perform at their own pace. An asynchronous method may include recorded videos produced by the instructor.

Synchronous: a method that more resembles in-class instruction, possibly by conducting virtual (ZOOM) sessions during class times.

Hybrid: A combination of the two methods.

Next, students were asked the following questions:

- Did you work (perform a job outside of your coursework) during the Spring 2020 semester? (Choices: Yes/no)
- During the Spring 2020 semester, which method of teaching did you prefer? (Choices: asynchronous, synchronous, hybrid)
- Please describe the type of method you preferred, and why. (Write-in response).
- How many of your classes were conducted asynchronously? (Choices: 2 (classes), 3,4,5,6).
- How many of your classes were conducted synchronously? (Choices: 2,3,4,5,6).
- How many of your classes were conducted using a combination of asynchronous and synchronous methods (hybrid)? (Choices: 2,3,4,5,6).
- Please choose the statement that best describes how you feel:
  - Emergency Remote Teaching should not include virtual sessions.
  - Emergency Remote Teaching should include virtual sessions, but not for the majority of class sessions.
  - Emergency Remote Teaching should have virtual sessions for the majority of class sessions.

Results were analyzed using tests of chi-squared significance and confidence intervals, along with qualitative methods of analysis described by Saldana (2015).

FINDINGS

Description of sample

Seventy-nine students responded to the survey (n=79, a survey response rate of 37%). Ninety-three percent of the students took five or more classes; fifty-nine percent indicated they worked a job outside of their coursework during the semester.

Research question 1: Distribution of perceived delivery methods

In terms of the number of asynchronous, synchronous and hybrid classes they participated in within the semester, 86% of students categorized between 0-3 of their classes as asynchronous, 91% of students categorized between 0-3 of their classes as synchronous, and 91% of students categorized between 0-3 of their classes as hybrid. The differences between these responses was not found to be statistically significant by a chi-squared test. The distributions for these responses are depicted in Table 1.

Table 1: *Distribution of perceived delivery methods*

# of asynchronous classes	# Responses	Relative frequency	Cumulative frequency
0	12	0.16	0.16
2	39	0.51	0.66
3	15	0.19	0.86
4	9	0.12	0.97
5	2	0.03	1.00
6	0	0	1.00
# of synchronous classes	**# Responses**	**Relative frequency**	**Cumulative frequency**
0	15	0.19	0.19
2	37	0.48	0.68
3	18	0.23	0.91
4	5	0.06	0.97
5	2	0.03	1.00
6	0	0	1.00
# of hybrid classes	**# Responses**	**Relative frequency**	**Cumulative frequency**
0	26	0.34	0.34
2	27	0.35	0.69
3	17	0.22	0.91
4	3	0.04	0.95
5	3	0.04	0.99
6	0	0.00	0.99

Research question 2: Method of delivery preference

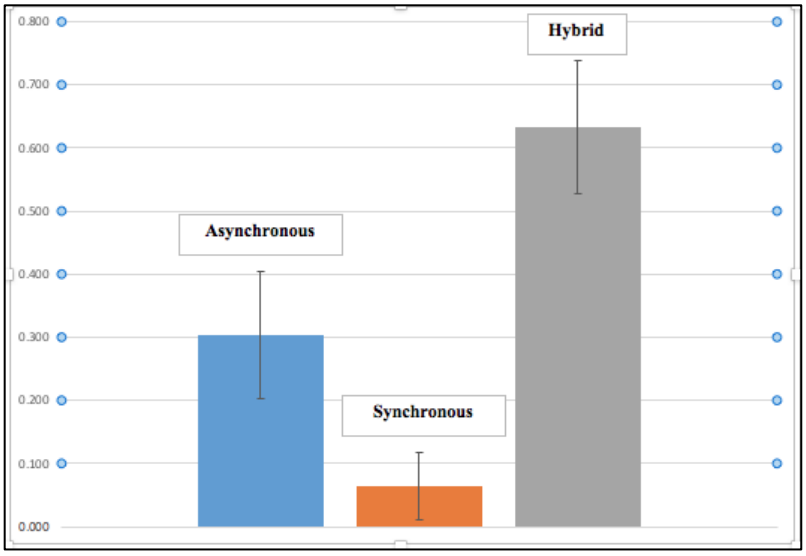
Among asynchronous, synchronous and hybrid methods of delivery, 50/79 responses preferred the hybrid method of delivery (Chi-squared statistic = .3875, $p < .01$). These results are depicted in table 2.

Table 2: *Method of delivery preference*

Asynchronous	24
Synchronous	5
Hybrid	50

Based on the sample proportion of students who preferred the hybrid method, a 95% confidence interval (n=79, p=.633, Z=1.96) has 52.6% to 73.9% of the larger population preferring a hybrid method of delivery during Emergency Remote Education, as opposed to the asynchronous or synchronous methods. Confidence intervals for asynchronous, synchronous and hybrid methods of delivery are depicted in Figure 2.

Figure 2: *Confidence intervals for asynchronous, synchronous and hybrid methods of delivery*



Qualitative analysis of 32/50 write-in 'hybrid' responses showed perceived flexibility of the hybrid method as the leading theme (17/32 responses), with the supporting sub-themes of the hybrid method best supporting student's ability to work at their own pace and within the different schedules and environments by being at home versus school. A secondary leading theme of the hybrid method was the 'professor' and fellow student contact (12/32 responses). The use of recorded lectures and instruction was also highlighted (7/32 responses) as reasons for preferring the hybrid method.

Qualitative analysis of 19/24 write-in 'asynchronous' responses showed difficulty of home and work environments, to include different schedules, as the leading theme (8/19 responses). Easier to focus, ability to work at one's own pace was a secondary theme (4/19 responses), as was the value of being able to reference pre-recorded video content (4/19 responses). Qualitative analysis of 4/5 write-in 'synchronous' responses highlighted the structure of this respective method.

Research question 3: Frequency of virtual session preference

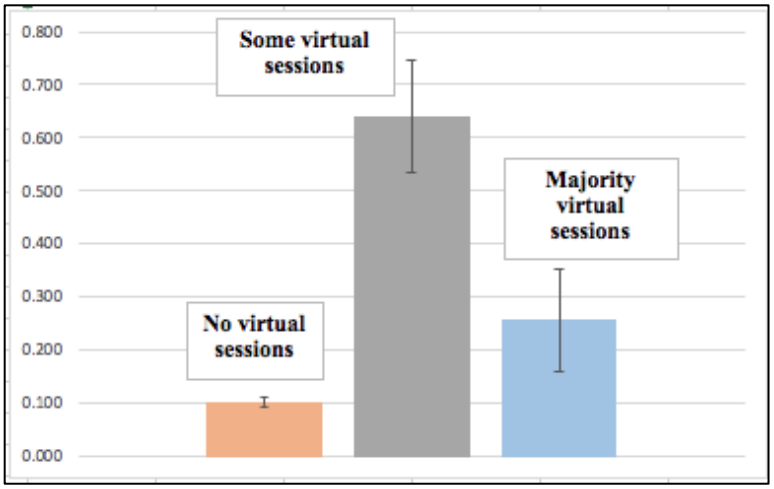
With regard to the frequency of virtual sessions (none, some, or for the majority of ERT sessions), 50/78 responses preferred some virtual sessions (chi-squared statistic = 36, p<.01). These results are depicted in table 3.

Table 3: *Frequency of virtual session preference*

No virtual sessions	8
Some virtual sessions	50
Majority virtual sessions	20

Based on the sample proportion of students who prefer some virtual sessions, a 95% confidence interval (n=78, p=.641, Z=1.65) has 53.4% to 74.7% of the larger population preferring some virtual sessions during Emergency Remote Education, as opposed to the majority or none. Confidence intervals for the frequency preference of virtual sessions are depicted in Figure 3.

Figure 3: *Confidence intervals for asynchronous, synchronous and hybrid methods of delivery*



The write-in comments for frequency of virtual session preference were less distinct, with less emerging themes in comparison to the write in comments for preference of delivery method. Across the three options, 45 write-in comments were gained from 78 responses. Within the 45 comments, themes concerning the efficacy of virtual sessions varied, ranging from virtual sessions being optional and video screens during virtual session being optional, to virtual session attendance and participation being mandatory. Benefits of virtual sessions listed were contact with professors and fellow students and the virtual session's similarity to a resident class. Weaknesses and criticisms of virtual sessions included difficulty in preserving focus, technical difficulties, and feelings that virtual sessions should not be required for all courses or class sessions.

Research question 4: Impact of course loads

Although the amount of classes taken compared to the preference of delivery method was found to be statistically significant at the .05 level of significance (chi-squared statistic = 16.97, p <.05), 82.8% of this respective chi-squared statistic was due to the difference between the small amount of students taking two classes (1) and the expected value (.0625, producing a respective chi-squared contribution of 14.0625). When performing a chi-squared analysis of only the preferences of students taking five and six classes, these results were not found to be statistically significant. The amount of classes taken versus method of delivery preferences is depicted in Table 4.

Table 4: *Amount of classes taken versus method of delivery preference*

Amount of classes taken	Asynchronous	Synchronous	Hybrid	Totals
2	0	1	0	1
3	0	0	1	1
4	2	0	2	4
5	13	3	31	47
6	9	1	17	27
Totals	24	5	51	80

Additionally, the relationship between the number of classes taken and virtual session preference was not found to be significant.

Research question 5: Impact of working/non-working status

The relationship of work versus method of delivery preference and work versus frequency of virtual session preference were both not found to be significant.

ANALYSIS

There may be a disconnect between the manner educators feel Emergency Remote Teaching should be delivered by instructors, and how it is preferred by students. While instructors varied consistently in their methods of delivery, with asynchronous, synchronous and hybrid methods being divided in near equal amounts, student preference did not vary in the same manner. Instead, the preponderance of student preference was in the hybrid method of delivery, due to its combination of flexibility and support. Given the limited time to prepare, adjust and continue courses during the outbreak, this disconnect seems understandable and almost expected; however, if left unaddressed, this disconnect could degrade the overall effectiveness of higher education as the Coronavirus continues and colleges use Emergency Remote Teaching as a method. Future research could explore the deeper needs that drive the students' desire for both flexibility and support, specifically in areas of motivation, engagement and feedback, that expand, compare and contrast previous models concerning traditional online pedagogy such as the Community of Interest (CoI), constructivism, active and deep learning.

The results concerning student preferences on the frequency of virtual sessions complements the combined desire of flexibility and support during the crisis environment. With the majority of responses in the "some, but not all" preference for the amount of virtual sessions used, instructors who adopt virtual sessions in conjunction with a synchronous method, or use no virtual sessions in an asynchronous method, may be met with mixed results in terms of student motivation, participation and focus. Determining the optimal range of virtual sessions that achieves a balance between the student needs of flexibility and support, as well as the length and type of virtual sessions, are areas of future research that would expand the body of work on Emergency Remote Teaching. As "best practices" with the field of Emergency Remote Teaching are yet to be determined, research in this particular area could assist educators within the present day.

Interestingly, the variables of working a job outside of coursework, or the frequency of classes taken, did not affect the overall student preferences for the hybrid method and amount of virtual sessions used. This indicates that within the crisis environment, working students, as well as those taking a small number of classes, still preferred the combined flexibility and support that the hybrid and moderate virtual sessions provided. As with the other observations, this prompts future students towards variables that might change this pattern of preference, such as disciplines of study, age or gender.

SUMMARY AND CONCLUSION

These findings indicate that the students sampled did not perceive their Spring 2020 semester as conventional on-line education or traditional college conducted at a distance. Instead, students experienced the semester as a new environment, involving displacement, new settings, and the friction of different family, work and home variables. With this in mind, sampled students preferred the hybrid method's perceived flexibility to accommodate the needs of this new environment, giving them the ability to work at their time, pace and choosing, being able to watch recorded content in areas they felt comfortable, and gain in-person contact with faculty in areas they did not. As business students, studying mathematically based material such as accounting, economics, finance, statistics, operations management and supply chain, this ability to get assistance when needed was particularly important. At the same time, these preferences were not affected by independent variables such as working a job in addition to coursework, or the number of classes taken, which indicates they may be reflective of the general students sampled. Overall, these findings reflect the pattern seen in the limited previous studies on the topic.

With the Coronavirus still spreading and a vaccine not yet in distribution, Emergency Remote Teaching continues to be employed as a method of providing higher education. While some colleges and universities began the Fall 2020 semester with Emergency Remote Teaching as the primary plan, others have chosen to revert to Emergency Remote Teaching after attempts at resident instruction resulted in Coronavirus spread (Alexander, 2020). Therefore, Emergency Remote Teaching remains an ongoing and emerging practice; understanding and addressing the combined flexibility and support needs of students will contribute to its efficacy.

REFERENCES

Alexander, B. (2020). More toggle term campuses. Retrieved from https://bryanalexander.org/coronavirus/more-toggle-term-campuses/

Breeze, D., Buckley, P., & Gilmore, F. (2011) Challenging perceptions of blended learning in an adverse learning context. In G. Williams, P. Statham, N. Brown, & B. Cleland (Eds.) Changing demands, changing directions. Proceedings of the 28th ASCILITE Conference (pp. 179-181). Hobart, Australia: University of Tasmania. Retrieved from http://www.ascilite.org.au/conferences/hobart11/downloads/papers/Breeze-poster.pdf

Czerniewicz, L., Trotter, H., & Haupt, G. (2019). Online teaching in response to student protests and campus shutdowns: academics' perspectives. *International Journal of Education Technology in High Education*, *16(*1).

Garrison, D. R., & Vaughan, N. D. (2008). *Blended learning in higher education: Framework, principles, and guidelines*. San Francisco, CA: Jossey-Bass.

Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, T. (2020). The difference between emergency remote teaching and online learning. Available at https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning

Jones, Ida M. (2011). Can you see me now? Defining teaching presence in the online classroom through building a learning community. *Journal of Legal Studies*, *28*(1).

Mackey, J., Gilmore, F., Dabner, N., Breeze, D., & Buckley, P. (2012). Blended learning for academic resilience in times of disaster or crisis. *Merlot Journal of Online Learning and Teaching. 8*(2).

Panferov, Vladmir N. (2020). Efficiency of learning and academic motivation of students in conditions of online interaction with the teacher (on the example of video-lecture). *Social Psychology and Society. 11*(1).

Saldana, J. (2015). *The coding manual for qualitative researchers*. London: SAGE Publications.

Serrano, D., Dea-Ayuela, M., Gonzalez-Burgos, E., Serrano-Gil, A, & Lalatsa, A. (2019). Technology-enhanced learning in higher education: How to enhance student engagement through blended learning. *European Journal of Education*, *54*(2).

Tull, S., Dabner, N., & Ayebi-Arthur, K. (2017). Social media and e-learning in response to seismic events: resilient practices. *Journal of Open, Flexible and Distance Learning, 21(*1).

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SURVIVAL STRATEGIES OF JAPANESE AMUSEMENT ARCHADES: A CASE STUDY

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ABSTRACT

Japanese amusement arcades called game-centers have tried to survive. Independent game-centers without financial power have mostly struggled to find the best possible way to stay (Livedoor, 2015; Thutmosev, 2015; Nomu, 2016; SPEEDA, 2017; Chiba, 2018; Kamohara, 2019a). For such game-centers, focusing on an attractive niche segment may be the best possible strategic option to survive (Thutmosev, 2015; Sankei, 2016; Hirakawa, 2019; Kamohara2, 2019). This paper will discuss Japanese game-centers' strategies in a retro video game niche. We will then study one of the most successful game-centers to develop a general model of game-centers' survival strategies in the niche.

INTRODUCTION

Japanese amusement arcades called game-centers have tried to find ways of surviving. Especially, independent game-centers with limited financial capacities have struggled to find the best possible way to stay (Livedoor, 2015; Thutmosev, 2015; Nomu, 2016; SPEEDA, 2017; Chiba, 2018; Kamohara, 2019a).

Empirical studies have told us that such independent game-centers have focused on niche segments: senior persons, hardcore game-players, families, shoppers at shopping malls, young couples, and kids (Murakami, 2015a; Thutmosev, 2015; Excite, 2016; Sankei, 2016; BEEP, 2017a; Hirakawa, 2019; Kamohara2, 2019; Nakajima, 2019).

While there are several niches for independent game-centers, a retro video game niche has been the most attractive niche. A significant motivation for this move is the lower cost of transformation as they already have many outdated video game machines or retro game machines. They can also quickly expand variations of retro games because they can buy them at fractions of the new game machines cost (Gamespark, 2013; HRCRF2, 2014; Murakami, 2015b; BEEP, 2017b).

This paper will discuss Japanese game-centers' strategies in a retro video game niche. We will then study one of the most successful game-centers to develop a general model of game-centers' survival strategies in the niche.

LITERATURE REVIEW

In the 90s, there were more than 30,000 Japanese amusement arcades or game-centers. However, by the year 2019, we have less than 5,000 centers because many arcade game players have left game-centers for PC games, online games, and games on their smartphones (JAMMA, 2010; HRCRF2, 2014; Livedoor, 2015; Nomu, 2016; BEEP, 2017b; SPEEDA, 2017; JAIA, 2018).

A continuous increase in Japanese consumption tax has also negatively influenced game-centers because it reduced the per-play profitability of a video game machine. While game-centers can cover the tax by increasing the per-play price, they have not been able to do it quickly because it requires a large investment to modify game machines. After all, most centers have sacrificed their profits for the consumption tax (HRCRF2, 2014; Murakami, 2015c; Nomu, 2016; BEEP, 2017b; Ebitsu, 2019; Uedaman, 2019).

The declining population of teenagers, a primary target segment, has damaged the operations of game-centers. In addition, the centers' harmful and unhealthy images have let many teenagers stay away from game-centers (JAMMA, 2010; Thutmosev, 2015; Nomu, 2016; RNAVI, 2019).

However, there are still business opportunities. For example, instead of teenagers, senior persons have started visiting game-centers almost every day to kill their free time. They will play easy-to-play games for hours, buy canned beverages and cigarettes from vending machines, and allow their grandkids to play games. Many senior customers have visited game-centers every day to exercise their brains by playing video games. Even if they do not play games, they will visit game-centers to socialize with other seniors. According to researchers, a senior tends to spend more than $200 per month in a game-center (Thutmosev, 2015; Sankei, 2016; Chiba, 2018; Hirakawa, 2019; Kamohara2, 2019).

Removal of operational restrictions by the Japanese government may increase game-centers' profitability as they can operate twenty-four hours a day (Thutmosev, 2015; BEEP, 2017a; Chiba, 2018; Hirakawa, 2019; Kamohara, 2019a).

Some game-centers have opened mini-game-centers in shopping malls to attract families and seniors with grandchildren. As the mini-game-centers tend to generate much higher per square profitability with fewer employees, they can enjoy lower labor costs and higher profits (Okada, 2009; Murakami, 2015b; Excite, 2016; Sankei, 2016; BEEP, 2017b; BEEP, 2017a; Fujisawa, 2018; JAIA, 2018; TBS, 2018; Famitsu, 2019; Hirakawa, 2019; Kamohara2, 2019; Mikado, 2019; Nakajima, 2019; Oguhei, 2019).

While there are several niche segments, one of the successful segments is a retro game segment (Hijiyan, 2013; Nomu, 2016; IGCC, 2018; TBS, 2018; Fantasista, 2019; Mikado, 2019; Robot, 2019). In the niche, game-centers have effectively used what they have: experiences, old video game machines, good old inside atmosphere, and employees' knowledge of old video games. The segment will be more prominent as the retired first-generation arcade video game players have started to enjoy their retirement.

There are critical points for game-centers to be successful in the niche. They need proper maintenance of the game machines and variations of popular retro games (Hijiyan, 2013; Nomu, 2016; IGCC, 2018; TBS, 2018; Fantasista, 2019; Mikado, 2019; Robot, 2019). They need to fill their spaces with retro game machines instead of arcade crane machines and arcade prize-redemption game machines. They also need to place various vending machines in small rest areas and capsule toy vending machines in front of the centers.

However, these actions are not enough for them to enjoy the survivors' benefits. They still need differentiation by developing loyal communities where hardcore retro game players regularly get together for practices, competitions, socialization, and special events (Fujisawa, 2018; IGCC, 2018; TBS, 2018; Mikado, 2019; Uedaman, 2019). Having such loyal communities will bring them more profit as players play more, buy goods more, pay for various events, and even become self-assigned promoters through word-of-mouth, publicities, and social networks (Fujisawa, 2018; IGCC, 2018; TBS, 2018; Mikado, 2019; Uedaman, 2019).

A GENERAL MODEL OF RETRO GAME NICHE STRATEGY

We expect that game-centers using our model can make sustainable profits and enjoy the survivors' benefits in the retro game niche. We summarized the model in Table 1.

There are five actions in this model. The first action is to install many attractive retro video game machines. If game-centers already have such machines, it will be necessary to continue daily maintenance to keep them in good condition. In case there are not enough attractive machines, they must purchase them at a low cost.

The second action is to install several arcade crane machines and arcade prize-redemption game machines, which will bring additional profits to them. Because game players tend to come with companions, their companions will play these game machines while they enjoy retro games.

The third action is to organize a variety of events for loyal customers to increase profits. Game-centers should work with loyal customers to organize the events. Participating customers tend to promote "their events" through social media.

The fourth action is developing two communities: senior game player community and loyal retro game player community. Seniors can come every day for small talks in comfortable rest areas and playing games together. Seniors will spend more money on various vending machines in the rest areas as they will buy cigarettes, drinks, and foods.

The fifth action is to maintain minimum operation costs. Retro game-centers' operating expenses tend to be high because of special maintenance for old machines, retro video game circuit boards, and inside temperature.

Table 1: *General Model of Retro Game Niche Strategy*

1: Install many attractive retro video game machines. Maintain good conditions of the machines. Try to find ways to purchase retro video game machines at a low cost.
2: Create store environments where both game players and their companies can have a great time. In addition to the attractive machines, install vending machines, arcade crane machines, and arcade prize-redemption game machines.
3: Organize a variety of events for loyal and hardcore retro game players. Let the players be involved in organizing the events. Encourage the players to promote events through social media.
4: Create two types of communities: hardcore retro game players and seniors.
5: Minimize operation costs, especially maintenance costs, rent, and labor costs.

VERIFYING OUR MODEL

To verify our model, we interviewed senior-level employees of VGMR between August and October in 2019. VGMR has been one of the most successful retro game-centers in Japan. During the interview, we found that VGMR took very similar strategic moves to what our model suggests.

First, VGMR installed more than 150 retro game machines in a large warehouse. Because the machines were popular and rare, hardcore retro game players started visiting from all over Japan. Also, as all employees acquired maintenance skills, anyone could do maintenance to ensure machines' excellent condition. They also actively purchased retro machines at a low cost to expand variations of retro games.

VGMR created a comfortable rest area where anybody could enjoy vending machines, capsule toy machines, arcade crane machines, and arcade prize-redemption game machines.

VGMR organized various events with loyal players. For example, they organize events such as free-plays, one-coin-plays, and game competitions every week. Event participants promoted the events through social media.

VGMR developed two communities of customers: a loyal customer community and a senior customer community. The loyal customers organized various events, promoted them on social media, and even recruited new members. The loyal customers frequently visited the game-center to spend more money playing games, using vending machines, and purchasing store-brand products.

The senior customers enjoyed free time to play retro games with friends or grandchildren. They visited the game-center almost every day to play games and socialize with friends. They spent good money on various vending machines during the socialization.

VGNR minimized the center's operation costs by employing part-timers and relocating it to a rural area of Saitama-prefecture to enjoy lower rent and a large car parking.

Based on our interview, we could verify our model's potential effectiveness for game-centers focusing on the retro game niche through a series of interviews.

SUMMARY

We verified the effectiveness of our niche strategy model with one of the most successful game-centers. Suppose an independent game-center with limited financial capacity wants to survive in Japan's retro video game segment. In that case, they should (1) install many attractive retro video game machines in good condition, (2) make store environments comfortable for game players and their companies, (3) organize a variety of events for hardcore retro game players with loyal customers, (4) create communities for hardcore retro game players and seniors, and (5) minimize operation costs.

REFERENCES

BEEP. (2017a, March 8). *Memories of game centers*. Retrieved 2019, from Game Music: https://gmdisc.com/archives/1044

BEEP. (2017b, March 19). *Game over of game center business*. Retrieved 2019, from Game Music: https://gmdisc.com/archives/984

Chiba, C. (2018, May 15). *Revivals of game centers in shopping malls*. Retrieved 2019, from Citrus: https://citrus-net.jp/article/57933

Ebitsu. (2019, September 8). *A store manager of a game center said, "We may have to close by the end of September."* Retrieved 2019, from Ebitsu: http://ebitsu.net/archives/80104040.html

Excite. (2016, March 9). *Seniors in day-time game centers! Socialization? Prevention of arzheimer?* Retrieved 2019, from Excite News: https://www.excite.co.jp/news/article/HealthPress_201603_post_2284/

Famitsu. (2019, September 5). *Tokyo game show 2019*. Retrieved 2019, from Famitsu: https://www.famitsu.com/news/201909/05182612.html

Fantasista. (2019, September 3). *Welcome to Fantasista*. Retrieved 2019, from Fantasista: https://yaplog.jp/am-fantasista/

Fujisawa, B. (2018, January 29). *The Mecca of Retro Games in Northern Japan "Dhinos Sapporo Chuo*." Retrieved 2019, from IGCC: https://igcc.jp/ディノス札幌中央/

Gamespark. (2013, May 23). *Interview with Mr. Tetsuro Tuji, Director of Japan Museum of Video Game*. Retrieved 2019, from Games Park: https://www.gamespark.jp/article/2013/05/23/40955.html

Hijiyan. (2013, November 12). *Game center robot*. Retrieved 2019, from Tablekotainahibi: http://bz504178zb.blog.fc2.com/blog-entry-239.html

Hirakawa, S. (2019, May 9). *The way of game centers' survival*. Retrieved 2019, from Note: https://note.mu/hey_game/n/n2e345fd7c330

HRCRF2. (2014, March 11). *Ways of game centers' survival #1*. Retrieved 2019, from HR CRF2: https://blogs.yahoo.co.jp/hr_crf2/64166315.html

IGCC. (2018, April 26). *The mecca of retro video game in North-Kanto area: VGM Robot Fukaya*. Retrieved 2019, from IGCC: https://igcc.jp/vgmロボット/

JAIA. (2018, March 1). *Survey of the amusement industry of Japan (2018).* Retrieved 2019, from JAIA: https://jaia.jp/wp-content/uploads/2018/03/アミューズメント実態調査H28年度要約データ.pdf

JAMMA. (2010, December 31). *Survey of the amusement industry of Japan (2010).* Retrieved 2019, from JAMMA: http://www.jamma.or.jp/reference/data/survey_h22.pdf

Kamohara, M. (2019a, April 23). *The number of game centers became 1/5 of the booming era*. Retrieved 2019, from Yahoo News: https://news.yahoo.co.jp/byline/shigiharamorihiro/20190423-00122897/

Kamohara, M. (2019b, July 8). *The reality of chairs in game centers*. Retrieved 2019, from DenFamicoGamer: https://news.denfaminicogamer.jp/kikakuthetower/190708b

Livedoor. (2015, October 23). *Elders go to game-centers. Do they give the centers profits?* Retrieved 2019, from Livedoor News: https://news.livedoor.com/article/detail/10743082/

Mikado. (2019, September 2). *Welcome to Mikado*. Retrieved 2019, from Mikado: http://mi-ka-do.net/baba/

Murakami, M. (2015a, December 8). *Sphygmomanometer and radio exercise: Can game centers become social clubs of seniors?* Retrieved 2019, from Itmedia: https://www.itmedia.co.jp/lifestyle/articles/1512/08/news020.html

Murakami, M. (2015b, December 12). *Game centers forever: Introducing e-money*. Retrieved 2019, from Itmedia: https://www.itmedia.co.jp/lifestyle/articles/1512/12/news007.html

Murakami, M. (2015c, December 12). *Game center forever: Introducing e-money #2*. Retrieved 2019, from Itmedia: https://www.itmedia.co.jp/lifestyle/articles/1512/12/news007_2.html

Nakajima, Y. (2019, June 3). *Crane games are hot! Making profits!* Retrieved 2019, from Asahi Newspaper Digital: https://www.asahi.com/articles/ASM5R6HHMM5RPLFA00D.html

Nomu. (2016, August 1). *Survival of game centers Vol 1*. Retrieved 2019, from BayonWeb: http://bayon-game.com/?p=12603

Nomu2. (2016, August 8). *The survival of game centers Vol 2*. Retrieved 2019, from Bayon Web: http://bayon-game.com/?p=12773

Oguhei. (2019, April 13). *Report: Super2X event at Robot Fukaya*. Retrieved 2019, from Oguhei: https://oguhei.net/2018/04/21/gamecenter_fukayarobo/

Okada, Y. (2009, August 10). *Video game cener segment diminishing: Taito's survival strategy*. Retrieved 2019, from Itmedia: https://www.itmedia.co.jp/news/articles/0908/10/news016.html

RNAVI. (2019, May 31). *DataBase for game center industry*. Retrieved 2019, from Research Navi of Japan National Library: https://rnavi.ndl.go.jp/research_guide/entry/theme-honbun-102717.php

Robot. (2019, August 5). *Welcome to robot*. Retrieved 2019, from Robot: http://www.roboto.co.jp/

Sankei. (2016, January 13). *Troubles with more expensive prizes as a way of game centers' survival*. Retrieved 2019, from Sankei News: https://www.sankei.com/affairs/news/160113/afr1601130002-n1.html

SPEEDA. (2017, July 8). *The future of game centers*. Retrieved 2019, from News Picks: https://newspicks.com/news/2354788/body/

TBS. (2018, February 4). *A retro game-center is making a profit of 10000000-yen per month*. Retrieved 2019, from TBS: https://www.tbs.co.jp/gacchiri/archives/2018/0204.html

Thutmosev. (2015, November 23). *Seniors' game centers exist? 20% of the total game center population is now seniors.* Retrieved 2019, from The World News: http://www.thutmosev.com/archives/48506321.html

Uedaman. (2019, February 5). *Will game centers die? Suggestions for game centers to survive*. Retrieved 2019, from Movie Scoop: https://doga.hikakujoho.com/moviescoop/55176200001518/

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FORECASTING GROSS STATE PRODUCT: A VIEW FROM NORTH DAKOTA

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ABSTRACT

Forecasting gross state product required an analysis of economic indicators that affected state activities in North Dakota. In this study, I conducted a multiple regression analysis that analyzed the relationship between the rate of change in total employees in five sectors of the North Dakota economy. Using time-series employment data between 1997 and 2017, I forecasted the rate of change in the change in North Dakota gross state product. Calculating the rate of change of the variables and data from the manufacturing, energy, transportation, agriculture, and life services industries, I was able to forecast with statistical significance, the rate of change in the change in North Dakota gross state product with a large R^2 = .9536.

INTRODUCTION

North Dakota is a state that holds many resources, natural and manufactured (Economic Development & Finance, 2020). Since 1998, the North Dakota economy has increased significantly as compared regionally and nationally (Caliendo, Parro, Rossi-Hansberg, & Sarte, 2018). There are five known areas of the North Dakota economy, which include manufacturing, energy, transportation, agriculture, and life services (METALS). This study aims to forecast the rate of change of the change in gross state product (GSP) in North Dakota (ND) based on the available data relating to the METALS sectors.

In statistical research studies, the data should be independently and identically distributed (IID) as well as within the same time to determine if trend, seasonality, and/or cyclicality existed within the various data sets between sectors (Nwogu, Iwueze, & Nlebedim, 2016). Selected trend, seasonality, and cyclicality tests conducted within a statistical software package; and for this study, STATA was the statistical software used to analyze and interpret the results. Creating correct and reliable forecasts may be dependent upon how well a person could foresee the unforeseen.

Researchers consider many different performance factors while developing and testing forecasts for efficiency and reliability (Shaffer, 2015; Gao & Yu, 2020). One factor could be demographics. Another factor could be financial stability in volatile markets. The ability of a researcher to incorporate the proper factors or variables into the forecast model depends upon the statistical relationship assessed between dependent and independent variables. In this study, I developed a linear regression to analyze and predict the rate of change in the change in ND GSP using five independent variables, METALS. The remaining sections of this paper will categorize the literature, determine statistical significance in data while analyzing and interpreting the results, and concluding about the predictive accuracy and reliability of the forecast model.

LITERATURE REVIEW

In this section, a review of the relevant literature that pertained to the development of this forecast model resulted in METALS. Again, the METALS are manufacturing, energy, transportation, agriculture, and life services in the ND state economy. In North Dakota, the economy has flourished over the last two decades that solidified the following sectoral activities.

Manufacturing

Over the past twenty years, North Dakota catapulted into a top-three manufacturing state in the United States (Economic Development & Finance, 2020). Earlier researchers showed that a part of the manufacturing sector impacts unemployment rates, wages, and investment decisions. Apap and Gravino (2017) built upon Okun's Law, which stated the relationship between unemployment and output, by sector and showed how manufacturing and services impacted unemployment rates in different ways, indicated as developments in respective sectors. Apap and Gravino's results showed that for one percent change in output, the manufacturing and service sector β coefficients were significant, statistically, at α = .10, α = .05, and α = .01, respectively.

Conversely, Zhang (2018) offered that there is an indirect correlation between manufacturing and unemployment controlling for offshoring activities; hence, affecting GSP negatively. Block (2019) detailed that updating

infrastructure projects in transportation and communications would require increased costs as compared to manufacturing. Chen and Cheng (2019) tested N = 704 observations for the relationship between entrepreneurism, technology manufacturing, bureaucratic regulations, and corruption using patents per capita data to predict gross state product. In five models, starting from a base model and adding independent and interaction variables, Chen and Cheng results concluded significant, statistically, OLS = -.359, α = .01, p < .001. These results showed a negative relationship because manufacturing has more barriers to entry; therefore, limiting the extent of entrepreneurial endeavors.

Furthering the employment outlook, Stokan (2019) defined local economic impact as employment, wages, and establishments as he studied the impact of earned income tax credits (EITC) on economic activity in border towns that adopted and did not adopt the credit. Stokan created a regression that included manufacturing as a control variable to show the impact on employment, wages, and establishments. Stokan designed a difference-in-difference model by industry and then analyzed N = 864 observations, using p-values, .10,.05, and .001, resulting in that the manufacturing control variable was not significant, statistically, as EITC rates = -.17, -.09, and -.001, as regressed against the economic impact variables, respectively. Unfortunately, the results proved insignificant, in that the EITC did not have an economic impact on the border towns, specifically in the manufacturing sector.

In an alternative view, Zhang (2019) argued how government programs targeting enterprise zones in declining areas; therefore, limiting the impact of established businesses to take advantage because of geographic operations and restrictions. Darmofal, Kelly, Witko, and Young (2019) collected dated from N = 48 states and developed a spatial diffusion forecasting model to predict de-unionization as output changes within the contiguous U.S. manufacturing sector. Darmofal et al. results proved significant, statistically, in the prior period, OLS = 9.53, α = .01, p < .001, meaning that as the decision-makers adjusted manufacturing levels in the preceding period, unionization levels correlated positively and significantly.

Energy

In recent years, North Dakota has become number two in oil and gas production in the United States (Weijermars, et al., 2017). During 2015, Brandt, Yeskoo, and Vafi examined the energy intensity of the Bakken oil deposit using a variable, net energy return, which is the difference between the energy generated and the energy consumed by extraction procedures such as traditional drilling and hydraulic fracturing. Munasib and Rickman (2015) examined the economic impacts of the oil and shale boom in Arkansas, Pennsylvania, and North Dakota. Munasib and Rickman used the synthetic control method to analyze and predict the economic activities and changes in oil and gas production in the three states. Munasib and Rickman found, with statistical significance, that North Dakota exceeded both Arkansas and Pennsylvania with quantifiable economic impacts surrounding the shale basin regions, respectively.

In 2016, Miljkovic and Ripplinger used a time-series analysis that included cointegration analysis and vector error correction analyzing the labor market impacts of the boom and bust within the Bakken Shale region. Miljkovic and Ripplinger conducted various tests and measures such as the Augmented Dickey-Fuller test to determine the robustness and validity of hypotheses. Miljkovic and Ripplinger found that a one percent increase in oil and gas wages resulted in a one-half of one percent decline in employment in the rest of the economy that created a labor transfer from the rest of the economy to the oil and gas sector. Additionally, in 2017, Wijermars et al. created a forecast model that analyzed the economic performance of wells in the Bakken shale region in North Dakota, Montana, and Saskatchewan, Canada. Wijermars et al. used a decline curve analysis to predict the economic performance of the wells in each region while using discounted cash flow analysis to revalue to basin within the three jurisdictions.

Using a different perspective, Pei, Korom, Ling, and Nasah (2016) compared the costs of underground coal gasification and natural gas conversion on a per thousand cubic meters basis in the Harmon lignite bed in North Dakota. Pei et al. completed the comparison by creating an underground coal gasification plant and calculated the development and operational costs. Pei et al. found that underground coal gasification is a competitive technology to natural gas conversion technology; albeit, a significant improvement, technologically, to the overall coal gasification process. Conversely, Rickman, Wang, and Winters (2017) used a synthetic control method that analyzed the relationship between educational attainment and shale oil and gas development. Rickman et al. showed the reduction in educational attainment correlated to oil and gas development in the major shale regions of the United States, such as the Bakken in North Dakota.

Moreover, Litzow, Neville, Johnson-King, and Weinthal (2018) studied the causal effect between oil and gas production and the socio-economic and environmental impacts by using fracking data as compared to regulatory outcomes. Litzow et al. showed the relationship between regulatory revenue sharing and fracking industry structure was significant, statistically, across production, cost, and elasticity. Furthermore, Salari and Javid (2016) developed a demand-based model to reduce residential energy consumption between the electric and gas sectors in the United States. Between Canada, Mexico/Chile, and the United States, the United States household energy consumption is 87% as compared to 8% and 5%, respectively. Salari and Javid used static and dynamic panel estimation models to forecast the demand for gas and electricity in the residential sector. Both models represented in the log-log specification because of the non-linear relationship between energy demand and temperature.

In 2018, Ghani, Vogiatzis, and Szmerekovsky designed a model that evaluated the efficiency of burning biomass feedstock to reduce emissions and to incentivize farmers to convert into energy. Ghani et al. created a linear program maximizing profits by varying emissions policies along with minimizing emissions using the North Dakota corn market for data. Ghani et al. results indicated that converting the feedstock into biofuels and added 20.5193% of profit could have been realized by the farmers. Farmers that utilize the biomass energy source may improve sustainability through cost minimization and profit maximization.

Transportation

Most of the transportation sector in North Dakota sources from the extraction and delivery of natural resources within the state. Earlier scholars identified various cost structures that affected location and investment decisions for sector improvement. Jensen, Hazelton, Wellman (2019) analyzed the terminology, specifically, the context in which policymakers used the word 'improvement' in transportation planning. Jensen et al. postulated that the context in which the policymakers used the word, the researchers determined the set of values that policymakers defined for themselves and the public. Understanding the thought process and what constitutes an 'improvement' supplied insight into the critical disclosure analysis performed by the scholars.

During 2015, Chen, Kriz, and Wang created an infrastructure health index and determined that transportation impacted a state's credit rating issued through Moody's or Standard and Poor's. Chen et al. said that poor infrastructure, specifically in transportation, wasted over $121 billion in total productivity. Chen et al. postulated that civil engineers considered road roughness, traffic congestion, and deficient bridges as assessment measures for state transportation department analyses. Therefore, Chen et al. hypothesized that infrastructure condition did not affect bond ratings; however, the results indicated Chen et al. results were significant, statistically, $\alpha = .1$, $\alpha = .05$, and $\alpha = .01$, *p*-values significant for all α levels; and that the health of state infrastructure impacted state bond ratings for Moody's and Standard and Poor's.

Alternatively, Gonela, Zhang, Osmani, and Onyeaghala (2015) designed a stochastic mixed-integer linear programming model, using ND agricultural data that determined five factors, one of which was the optimal transportation mode for moving and shipping bioproducts. Gonela et al. described three modes of transportation, pipeline, train, and truck, which supplied transportation cost data for the model. Gonela et al. controlled the model with demand, biofuel price, and biomass yield constraints the resulted in 81 uncertainty scenarios. Moreover, Sharifzadeh, Garcia, and Shah (2015) stated that transportation costs are a significant indicator in the biofuel sector, as costs are high because of safety, security, and regulations. Sharifzadeh et al. found a trade-off between the costs of biomass transportation and economies of scale to maximize profits throughout the supply chain.

Comparatively, Ortiz (2016) studied the impact of transportation costs on wheat prices and developed a predictive model based on increased transportation costs from increased demand for rail services transporting wheat. Hence, Ortiz created the model to predict wheat prices based on some function of transportation and storage costs; even though, transportation and storage costs are not direct costs. Therefore, to determine transportation costs, Ortiz further developed a model based on observable values related to nearby oil and ethanol prices along with an interaction term related to pipeline construction impacts. Creating predictive models can range from simple to complex depending on the data researched.

Later, in 2019, Oke, Huppmann, Marshall, Poulton, and Siddiqui developed a model that identified ways to minimize risk while transporting oil and gas resources within the ND region. Oke et al. analyzed the relationship between the

various transportation modes, including rail, pipeline, water (river and sea), and among heavy and light crude oil products. Oke et al. showed that rail capacity levels are twice as less than pipeline capacity constrained and controlled for distance, operating, and investment costs. Also, in 2019, Clay, Jha, Muller, and Walsh used transportation data, specifically from ND oil exports that assessed the relationship between the oil transported out, air pollution, greenhouses gas, and spill and accident risks between rail and pipeline. Clay et al. found that greenhouse gas and air pollution costs were double for rail than pipelines; and, the cost for using rail and pipeline was one-fifth and one-tenth, respectively, as compared to the combustion engine transportation.

Agriculture

One of ND's main sources of production derives from the agriculture sector, inclusive of forestry, hunting, fishing, and farming (U.S. Department of Commerce, 2020). Previous scholars analyzed the relationship between production inputs, weather, demand, bank deposits, and total ND agriculture output. Wang, Nehring, and Williams (2019) showed that since 1948, overall agricultural production rose over 170% with minimal change of inputs such as fertilizer, labor, pesticides, and machinery.

Seeking the demand outlook, Brock, Choi, Boyle, Moilanen, and Schillo (2016) experimented with $N = 61$ observations within Minnesota, North Dakota, South Dakota, and Wisconsin purchasing two tobacco smoke and two tobacco smokeless products that determined the net effect of tax increases on the retail sale of tobacco products. Brock et al. showed how the tax increases impacted Minnesota more significantly with a five-cent variation above the United States average. Moreover, a sign of the variable economic impact indicates that government regulations on agricultural products must be reformed to create equal sustainability across communities.

In a different view, Wang, Nehring et al. defined weather as minimal or short-term changes in temperature and precipitation while climate refers to a long-term outlook. Wang, Nehring et al. suggested that research posited high heat stress reduced livestock fertility, weight, and metabolic efficiency. Wang, Nehring et al. assessed heat stress on livestock from the Temperature-Humidity Index; and on crops, from the Oury Index that showed a strong relationship between climate and plant growth.

Comparatively, Kharel, Zheng, Kirilenkio (2016) created a hydrological model to help decide land-use alternatives relative to the change in land-use and climate to prevent overspill between natural geological formations. Kharel et al. stated that agricultural land-use received one-third of the federal disaster relief funds during the Devils Lake overspill into Stump Lake in North Dakota. Additionally, Kharel et al. developed an economic model to help farmers decide crop location, types, and other land-use alternatives within the Devils Lake watershed. The researchers' results indicated that the farmers decided on the crop through regulations, incentives, seeds, and soil productivity that yield maximum net economic returns, simply total income minus total expenses. However, the expenses can aggregate costs based on management, planting, harvesting, storing, and transporting among insurance and labor.

From a finance perspective, O'Hara (2017) examined community bank deposits and the impact on agricultural production in North Dakota, South Dakota, Minnesota, Montana, and Wyoming. O'Hara used instrument variable and first differences regressions to analyze and interpret the results. O'Hara stated that in 2014, community banks held 42% of farm-sector debt; however, post-industry lending consolidation, the merged institutions now held 77% of the sector debt as the top five institutions reduced holdings in the same sector.

However, in 2018, Bekkerman and Weaver studied the effect of the wheat stem sawfly on agricultural production to minimize expected losses by analyzing the joint distribution of infestation and various yield-reducing outcomes. Bekkerman and Weaver stated that most research dealing with natural hazards implemented biological effects into the regression to improve estimations. Bekkerman and Weaver named nine management alternatives to improve agricultural production dealing with the wheat stem sawfly. Alternative strategies included chemical controls, burning, nutritional control, biological control, tillage, strip cropping, solid-stem cultivars, trap cropping, and swathing. Furthermore, Bekkerman and Weaver posited that other factors such as wheat class, the cultivar, location, temperature, and expected precipitation impact wheat losses; however, an interdependency between infestation and these other factors remains evident.

Additional researchers found that inter-sector agreements and conservation regulations impacted agriculture data (Crowe, 2019; Wang, Jin, Kasu, Jacquet, & Kumar, 2019). Crowe (2019) analyzed farm data in three different shale

regions including Illinois, Pennsylvania, and North Dakota. Crowe's results showed that there is a serious disconnect between trust in oil and gas companies and farmers where at least 32% of all landowners do not trust the oil and gas companies to restore the land after use and to compensate landowners, appropriately. Also, Crowe created an ordinal and logistic regression to predict farm financing and investment based on the operational responses and the impact of shale development. The results varied and showed that there were notable differences between large and small crop farmers in terms of return on investment and the future of farming.

Furthermore, Fitzgerald, Kumayama, Olmstead, and Thompson (2020) analyzed the relationship between oil and gas development and crop production in the Bakken shale region of North Dakota. Fitzgerald et al. determined as the rate of oil and gas wells expanded, crop production in the same region declined to decrease carbon storage mediums such as plants and soils. Similar research from Wang, Jin, Kasu, Jacquet, and Kumar in 2019 compared economic and stewardship motivations that studied two soil conservation techniques that determined the best way to minimize soil degradation. Wang, Jim et al. stated that farmers must adopt soil conservation practices based on their respective situations. Wang, Jim et al. examined crop rotation and integrated cropping and livestock systems to help farmers best decide the proper methods to minimize soil degradation. Wang, Jim et al. designed a model that compared the traditional farming techniques with conservation farming techniques through an economic profit prediction model. Wang, Jim et al. results proved that for the paradigm to shift for farmers to adopt conservation methods, farmers required a premium for adopting practices.

Life Services

North Dakota offers to its residents a substantial amount of professional services that include finance, insurance, real estate, education, arts and entertainment, and health services (Economic Development & Finance, 2020; U.S. Department of Commerce, 2020). Prior researchers analyzed the linkages between efficiency, innovation, and productivity (Bieńkowska & Tworek, 2020; Prager, Foltz, & Barham, 2015). Prager et al. (2015) analyzed research performance and rates of publication among faculty in the life sciences discipline. Bieńkowska and Tworek developed a new construct that assessed an employee's dynamic capabilities on job performance that contributed to organizational sustainability. Bieńkowska and Tworek studied the ability of an organization, employees included, to adapt to changing environments. Bieńkowska and Tworek used several variables in a factor analysis that determined the relationship between dynamic capabilities, such as person-job fit and work engagement, and job performance. The results proved insignificant.

Moreover, Prager et al. stated that technology has shifted the publication processes that allow for improved efficiency and increased productivity. Prager et al. mentioned that microeconomic studies focused on a sector or firm-level data whereas the scope of their study examined the individual level. Prager et al. identified research inputs and outputs and the various rates of change from 1979 to 2005. Noticeable results from the Prager et al. study included the percentage increase in female research publications, 18.4%, up from 4.5%. Additional results showed researchers shifting topics from animal and plant sciences to environmental and food sciences.

In comparative research of the housing sector, Lutchenberg, Seiler, and Sun (2019) designed and executed a study that examined the effectiveness of pictures and words on homebuyers who decide to see the property from the viewed pictures and read words. Using asymmetry information and singling theory, Lutchenberg et al. developed a two-stage model that examined words and pictures to predict buyer behaviors, which is to see the property in person. Between-subjects and within-subjects test results indicated similarities between homebuyer and real estate broker perceptions of words and pictures and the effectiveness to initiate a showing on a property.

Jackson and Smith (2019), from an innovation standpoint, developed a model that identified technology-strong firms that purchase licensing for innovation in life science research and development. Jackson and Smith used regressions embedded within regressions to estimate purchase decisions. Making assumptions and propositions, Jackson and Smith developed purchase strategies based on the Nash equilibrium and game theories while defining pricing game parameters. The results indicated final licensing prices were not dependent upon initial pricing strategies.

Examining productivity, Kannan and Anandhi (2020) assessed literature that pertained to irrigation and the sustainability of food production while estimating changing demand, climate, and resource availability. Kannan and Anandhi postulated that mitigating and adapting food production to meet the changing demand, climate, and resource constraints, would require irrigation improvements and virtual water analysis.

In an associated productivity analysis of the Chinese environment, Li, Ding, and Yang (2020) developed a difference-in-difference model that estimated the interference of nonvalue added activities in green policy-making decisions. Li et al. used the model to assess the impact of the various green policies that changed the Chinese environment. The model estimated total factor productivity as a function of time and environment treatments. Li et al. used interaction variables to control for policy effects. Li et al. results showed policy decisions had positive and significant effects, regardless of control variables, on total factor productivity.

Gross State Product

Analyzing, interpreting, and predicting the overall output of an economy, precisely and accurately, can prove to be a difficult task for any scholar, business, or layperson (Rodgers & Joyce, 1996). Rodgers and Joyce examined stated budgets to determine state revenue forecast accuracy. The scholars studied prior and current research to prove prediction error explanations about over- and underestimating forecasts. Rodgers and Joyce showed that a minimal two percent error rate with a one-billion-dollar budget can swing the forecast by $20 million. That is significant correction for over or under budget estimation.

Conducting comparable research, Caliendo, Parro, Rossi-Hansberg, and Sarte (2017) examined regional productivity data to extrapolate sector elasticities that determined impacts, or productivity disturbances, on GDP and employment. Caliendo et al. created production and cost functions for regional and sector variables that affected GDP and employment. Caliendo et al. estimated the change in structure and labor by analyzing production functions that totaled all structures within a region used by various sectors with mobile labor.

In economics, researchers postulated that gross state product determined the strength of the state economy among its unique sectors (Delaney, 2019; Pallares & Adkisson, 2017). Delaney used a regression-based analysis of per-capita data to estimate the dollar volume state requirements given specific needs incurred by local economic activity. Pallares and Adkisson analyzed growth and stability in employment and determined the trade-off between quantity and reliability of employment. The scholars hypothesized if industrial diversification leads to reliable employment with sustainable growth in the sector. Pallares and Adkisson further categorized the data into volatile and nonvolatile states to determine variation in the data based on volatility. The researchers created a model that analyzed industrial concentration, sector volatility, export exposure, and annual employment growth.

The development of the predictive model variables for this study derived from the literature review related directly to the economy of the state of North Dakota. Upon evaluating the literature about the research variables, a scholar must build a theoretical foundation for the empirical study. Moving forward, I will ground this study in the following theoretical framework based on signaling theory.

THEORETICAL FRAMEWORK

Signaling Theory

In empirical research, analytics are necessary to determine the strength, reliability, and predictive power of the data (Ashiya, 2009). Scholars used signaling theory in prior studies to build the base for the current theoretical research framework (Busenitz, Fiet, & Moesel, 2005; Ashiya, 2009; Leung & Kwok, 2018; Luchtenberg, Seiler, & Sun, 2019). Busenitz, Fiet, and Moesel evaluated teams that signaled to venture capitalists' times to buy and sell investments based on personal holdings. Ashiya used signaling theory to determine a confidence level in forecast ability with extreme predictions. Leung and Kwok rooted their research in signaling theory that analyzed the impact of asymmetric information on dynamic business decisions in the merger and acquisition sector. Luchtenberg, Seiler, and Sun grounded their research in signaling theory and evaluated the effectiveness of words and pictures to entice consumers to purchase property. Using signaling theory, predicting the rate of change in the change in ND GSP based on METALS elasticity, proved significant, statistically.

METHODOLOGY AND METHOD

Forecast Methodology

A common approach to predictive analytics for annual time-series data is regression-based forecast modeling (Nwogu, Iwueze, & Nlebedim, 2016). In this study, I created a linear regression model that predicted the change in the rate of change in North Dakota Gross State Product. I created the independent variables from the available data retrieved from the Bureau of Economic Activity (BEA). The independent variables follow the literature review; however, I analyzed the year-over-year rate of change in total employees for an industry based in ND. The dependent variable is the year-over-year rate of change the change in ND GSP. Independent and dependent variables detailed in the model section below.

Forecast Model

The following forecast aims to predict the rate of change in the change in North Dakota Gross State Product using selective state data aggregated into the ND METALS model.

$$\Delta NDGSP_t = \beta_0 + \beta_1 * \Delta NDManufacturing_t + \beta_2 * \Delta NDEnergy_t + \beta_3 * \Delta NDTransportation_t + \beta_4 * \Delta NDAgriculture_t + \beta_5 * \Delta NDLifeServices_t + \varepsilon_t$$

where:

Δ refers to the rate of change in the predictive model variable.
$\Delta NDGSP_t$ is the rate of change in the change in ND GSP in time *t*.
$\Delta NDManufacturing_{it}$ is the change in total employees in the ND manufacturing sector in time *t*.
$\Delta NDEnergy_t$ is the change in total employees in the ND energy sector in time *t*.
$\Delta NDTransportation_t$ is the change in total employees in the ND transportation sector in time *t*.
$\Delta NDAgriculture_t$ is the change in total employees in the ND agriculture sector in time *t*.
$\Delta NDLifeServices_t$ is the change in total employees in the ND life services sector in time *t*.

The β coefficients are the employment elasticities for sector variables, where:

β_0 is the intercept of ND GSP
β_1 is the ND manufacturing employment sector elasticity.
β_2 is the ND energy employment sector elasticity.
β_3 is the ND transportation employment sector elasticity.
β_4 is the ND agriculture employment sector elasticity.
β_5 is the ND life services employment sector elasticity.

RESULTS

ΔND Manufacturing

Durable and nondurable goods make up the manufacturing industry (Zhang S. , 2019). In ND, manufacturers produce durable items such as wood, nonmetallic minerals, primary, and fabricated metal, machinery, computers, and electrical finished goods. Manufactures in ND also produce nondurable items, which include food, tobacco, textiles, apparel, petroleum, and chemical products. The following is the results summary of the rate of change of total employees in the ND manufacturing industry. The data showed that the average rate of change, μ = .0604, and the standard deviation, σ = .0889 between 1997 and 2017. The data also showed minimal skewness and typical kurtosis, meaning that the data is normally distributed, and outliers are minimal. Moreover, justification of the use of the change in total employees in the ND manufacturing sector to predict rate of change in the change in ND GSP is significant, statistically, not rejecting the null hypothesis. Figure 1 depicts a graphical representation of the percent change in the ND manufacturing sector between 1997 and 2017.

ΔND Energy

For this study, the ND energy sector made up of mining of oil and gas, mining other than oil and gas, mining support activities, and utilities. The inclusion of utilities contributing to the overall energy data was necessary to determine an overall ND energy market. In Table 2, the average rate of change for total employees in the ND energy industry, μ = .1298, and the standard deviation, σ = .2462 between 1997 and 2017. The data also showed minor skewness and regular kurtosis, meaning that the data is normally distributed, and outliers are minimal. Moreover, justification of the

use of the change in total employees in the ND energy sector to predict the percent change in the change in ND GSP is significant, statistically, not rejecting the null hypothesis. Figure 2 depicts a graphical representation of the rate of change in the ND energy sector between 1997 and 2017.

ΔND Transportation

In North Dakota, most of the transport is through pipelines extracting oil and gas reserves to local refineries to produce end goods for consumption (Oke, Huppmann, Marshall, Poulton, & Siddiqui, 2019). However, there are other data drivers for transportation data in the state. In this study, I included wholesale and retail trade data as transportation is necessary to move goods between manufacturers, wholesalers, and retailers. Additionally, transportation and warehousing are a specific sector of the ND economy; therefore, justifying the use of the percent change of total employees in the ND transportation industry proved significant, statistically, failing to reject the null hypothesis. Table 3 details the summary statistics, $\mu = .0604$, $\sigma = .0765$, for the change in total employees in the ND transportation sector while Figure 3 depicts the graphical representation of the data.

ΔND Agriculture

The agriculture sector in ND, traditionally, has been the primary sector to affect gross state product (Ortiz, 2016). The ND agriculture industry includes farming, fishing, forestry, hunting, and other related activities. Below are the detailed summary statistics in Table 4 for the rate of change, $\mu = .0895$, $\sigma = .2903$ in total employees in the ND agriculture sector. Figure 4 shows the visual representation of the sector data, showing volatility in the market. Including agriculture as a variable in this study proved significant, not rejecting the null hypothesis. Overall, the data showed a slight positive skew with a slightly below-normal kurtosis, meaning more outliers than typical.

ΔND Life Services

The life services sector of the ND economy is a fabricated sector for this study. The individual areas of commerce for the life services sector include information technology, finance, insurance, real estate, leasing, education, health, and other professional and business services, such as arts and entertainment. Table 5 and Figure 5, respectively, show the data details for the rate of change, $\mu = .0624$, $\sigma = .0335$ in total employees for the life services industry in North Dakota. Notably, the change in ND life services skewed negatively, slightly as compared to the other model independent variables.

ΔND Gross State Product

The state of North Dakota experienced monumental changes in different industries over the last two decades (Munasib & Rickman, 2015). The most influential changes in ND were in the energy sector with the advent of hydraulic fracturing, also known as fracking (Salari & Javid, 2016). Whether one is for or against the technology, it has changed miners' capabilities to pit and extract natural resources in the Bakken region (Pei et al., 2016). For this study, I determined that the change in total employees in the various ND sectors impacted the rate of change in the change in ND GSP. Using industry-related variables to predict the percent change in the change in ND GSP proved ideal and significant. As shown in Table 6, between 1997 and 2017, the rate of change in the change in ND GSP averaged 5.5%.

METALS

In this study, I elected to use 6 variables, 1 dependent variable, and 5 independent variables. The dependent variable is the percent change in rate of change in ND Gross State Product. The independent variables are the rates of change of the total number of employees in the manufacturing, energy, transportation, agriculture, and life services sectors of the ND economy. I used annual data between 1997 and 2017 to create the model and make predictions.

A pairwise correlation between *ΔNDGSP*, *ΔND MANUFACTURING*, *ΔND ENERGY*, *ΔND TRANSPORTATION*, *ΔND AGRICULTURE*, and *ΔND LIFE SERVICES* indicated statistical significance, and correlated, strongly and positively, as shown in Table 7, except for *ΔND MANUFACTURING*, which had the weakest correlation of the research variables. Another notable correlation was between *ΔND TRANSPORTATION*, *ΔND ENERGY*, and *ΔND LIFE SERVICES*.

Regressing *ΔND MANUFACTURING*, *ΔND ENERGY*, *ΔND TRANSPORTATION*, *ΔND AGRICULTURE*, and *ΔND LIFE SERVICES* on *ΔND GSP*, the regression results, detailed in Table 8, showed statistical significance among the variables with α = .05, *F*-statistic = 57.56 and *p*-value = 0. The beta coefficients of the independent variables showed an increasing rate of change for all variables. However, the *ΔND TRANSPORTATION* variable was not significant in the full model. A reason may be that the various methods of transporting energy resources where pipelines fill the role of eighteen-wheel tankers driving the resources to the refinery. Although the model specification is linear, the beta coefficients are the marginal rates of change; therefore, the beta coefficients considered sector elasticities. The R^2 value = .9536 meaning that the model can explain or predict 95.36% of the variability in *ΔND GSP*. Typically, this is a high rating and caused by simultaneous bias, unit roots, and minimal annual observations.

Upon further inspection of the regression analysis using the Interpolated Dickey-Fuller test, unit-roots were not present in the data, as displayed in Table 9, for *ΔND MANUFACTURING*, *ΔND ENERGY*, *ΔND TRANSPORTATION*, *ΔND AGRICULTURE*, and *ΔND LIFE SERVICES* as *Z*(t) scores for all variables were zero, approximately *Z*(t) = .0001, which indicated a rejection of the null hypothesis for unit roots. Moreover, the test statistic showed greater negativity than the critical values at all significance levels, which is another indication to reject the null hypothesis for unit roots. Also, the data is less likely to yield any changes in the distribution shape. Furthermore, the Durbin-Watson test statistic indicated a slight positive autocorrelation among variables, $d(6, 20) = 1.655$. However, displayed in Table 10, detection of white noise in the variables *ΔND MANUFACTURING*, *ΔND ENERGY*, *ΔND AGRICULTURE*, and *ΔND LIFE SERVICES* was present using the Portmanteau *Q*-statistic along with the χ^2 statistic.

Also, a vector autoregression indicated the variables with different lag times of 3,6, and 9. There was statistical significance in lag 1, 4, and 8, which would require further analysis beyond the scope of this study. Moreover, I predicted and tested *ΔND GSP* using *ΔND GSP_hat* to predict the shocks or movements in the independent variables not accounted for by the selected model variables. Furthermore, in Table 11, an ARIMA test showed a strong predictive model while the Akaike Information Criterion was negative, meaning significant goodness of fit for the forecast model.

VALIDITY AND RELIABILITY

In this study, an assessment of the validity and reliability of the forecast model of gross state product yearly percent change of $N = 20$ observations between 1997 and 2017, which determined the model to have significant predictive power with an $\overline{R^2}$ = .937 and statistical significance at the 95% confidence level among pairwise variable correlations. I further found validity and reliability concepts to support the generalization of the model to a larger population.

Validity

Empirical research studies are subject to internal and external validity (Maerlender, Palamara, & Lichtenstein, 2020; Turner, Bowen, Ryan, & Hayes, 2020; Zhang, Cao, Tay, Luo, & Drasgow, 2020). Researchers threaten internal validity through data manipulation and inferences while external validity allows the scholars to generalize to a broader data set. Maerlender et al. (2020) studied the criterion validity of scales that determined students learning functionalities. Similarly, Turner et al. (2020) tested convergent validity among scales that assessed resiliency in adolescents under stress. Zhang, Cao et al. (2020) evaluated measurement and predictive validity among personality assessment research point scales and found that point models have increased validity compared to predictive validity.

Reliability

Consistency in research repetition is critical to study reliability (Wesolowski, 2020; Witulski & G.Dias, 2020). Wesolowski analyzed the reliability in the quality of learner music evaluations. Wesolowski also defined reliability in classroom assessments as the dependability of the evaluation tool to support inferences about student-learning outcomes, accurately. Moreover, Wesolowski defined reliability over large-scale evaluations as the replication consistency of the testing procedures. Comparatively, Witulski and Dias showed the strength of a study through the assessment of construct reliability in sustainable development analysis among social, environmental, and economic constructs. Also, Witulski and Dias stated that study reliability proved significant internal consistency with testing Cronbach's alpha and goodness of fit measures.

CONCLUSION

The basis of this research was to forecast or to predict the rate of change in the change in North Dakota Gross State Product using aggregate employee data from the ND manufacturing, energy, transportation, agriculture, and life services sectors. I retrieved the annual data from the Bureau of Economic Activity. Transformation of the annual data into year-over-year percentage change allowed for a comparison between the change in total employees and the change in ND GSP. Assessing the rates of change in research variables indicated sector elasticities compared to the change in ND GSP. Mostly, the research variables were elastic. The predictive power of this forecast model was strong as measured by a large R^2 value with an RMSE at .0167 meaning that the average of the mean squared errors in the data was less than two percent. Moreover, the coefficients and variables tested statistically significant using *F* and *t*-statistics. Furthermore, I recommend expanding or improving upon this research in two ways. The first way is to obtain more observations, quarterly or monthly; and the second way is to improve the model specification into a polynomial or logarithmic function. Overall, the forecast model indicated strength, validity, and reliability in predicting the rate of change in the change in ND gross state product.

REFERENCES

Apap, W., & Gravino, D. (2016). A sectoral approach to Okun's Law. *Applied Economics Letters, 24*(5), 319-324. doi:10.1080/13504851.2016.1186789

Ashiya, M. (2009). Strategic bias and professional affiliations of macroeconomic forecasters. *Journal of Forecasting, 28*, 120-130. doi:10.1002/for.1095

Bekkerman, A., & Weaver, D. K. (2018). Modeling joint dependence of managed ecosystems pests: The case of the wheat stem sawfly. *Journal of Agricultural and Resource Economics, 43*(2), 172-194. Retrieved from https://jareonline.org/issues/

Bieńkowska, A., & Tworek, K. (2020). Job performance model based on employees' dynamic capabilities. *Sustainability, 12*, 2250. doi:10.3390/su12062250

Block, F. (2019). Financial democratization and the transition to socialism . *Politics & Society, 47*(4), 529-556. doi:10.1177/0032329219879274

Brandt, A. R., Yeskoo, T., & Vafi, K. (2015). Net energy analysis of Bakken crude oil production using a well-level engineering-based model. *Energy, 93*(2), 2191-2198. doi:10.1016/j.energy.2015.10.113

Brock, B., Choi, K., Boyle, R. G., Moilanen, M., & Schillo, B. A. (2016). Tobacco product prices before and after a statewide tobacco tax increase. *Tobacco Control, 25*(2), 166-173. doi:10.1136/tobaccocontrol-2014-052018

Busenitz, L. W., Fiet, J. O., & Moesel, D. D. (2005). Signaling in venture capitalist-new venture team funding decisions: Does it indicate long-term venture outcomes? *Entrepreneurship Theory and Practice, 29*(1), 1-12. doi:10.1111/j.1540-6520.2005.00066.x

Caliendo, L., Parro, F., Rossi-Hansberg, E., & Sarte, P.-D. (2018). The impact of regional and sectoral productivity change on teh U.S. economy. *Review of Economic Studies, 85*, 2042-2096. doi:10.1093/restud/rdx082

Chen, C., & Cheng, S. (2019). The effects of corruption and regulation on business entrepreneurship: Evidence from American states. *Public Performance & Management Review, 42*(6), 1481-1506. doi:10.1080/15309576.2019.1574593

Chen, C., Kriz, K. A., & Wang, Q. (2015). How does the health of transporation infrastructure affect state credit ratings? An empirical analysis. *Public Finance Review, 44*(5), 660-680. doi:10.1177/1091142115611742

Clay, K., Jha, A., Muller, N., & Walsh, R. (2019). External costs of tranporting petroleum products: Evidence from shipments of crude oil from North Dakota by pipelines and ral. *The Energy Journal, 40*(1), 55-72. doi:10.5547/01956574.40.1.kcla

Crowe, J. A. (2019). The impact of shale development on crop farmers: how the size and location of farms matter. *Agriculture and Human Values, 36*, 17-33. doi:10.1007/s10460-018-9882-4

Darmofal, D., Kelly, N. J., Witko, C., & Young, S. (2019). Federalism, government liberalism, and union weakness in America. *State Politics & Policy Quarterly, 19*(4), 428-450. doi:10.1177/1532440019851806

Delaney, J. (2019). Comparing apples to apples: Estimating fiscal need in the United States with a regression-based representative expendature approach. *Atlantic Economic Journal, 47*, 311-322. doi:10.1007/s11293-019-09626-5

Economic Development & Finance. (2020, May 12). Retrieved from ND Department of Commerce: https://business.nd.gov/

Fitzgerald, T., Kuwayama, Y., Olmstead, S., & Thompson, A. (2020). Dynamic impacts of U.S. energy development on agricultural land use. *Energy Policy, 137*, 111163. doi:10.1016/j.enpol.2019.111163

Gao, R., & Yu, X. (2020). How to measure capital investment efficiency: a literature synthesis. *Accounting & Finance, 60*, 299-334. doi:10.1111/acfi.12343

Ghani, N. M., Vogiatzis, C., & Szmerekovsky, J. (2018). Biomass feedstock supply chain network design with biomass conversion incentives. *Energy Policy, 116*, 39-49. doi:10.1016/j.enpol.2018.01.042

Gonela, V., Zhang, J., Osmani, A., & Onyeaghala, R. (2015). Stochastic optimization of sustainable hybrid generation bioethanol supply chains. *Transportation Research Part E: Logistics and Transportation Review, 77*, 1-28. doi:10.1016/j.tre.2015.02.008

Jackson, J., & Smith, J. (2019). Innovation of agricultural biotechnology with experimental use licensing. *Journal of Agricultural and Resource Economics, 44*(1), 1-15. doi:10.22004/ag.econ.281310

Jensen, C., Hazelton, J. K., & Wellman, G. (2019). Finding "improvement" in the language transportation planners use: A critical disclosure analysis to illustrate an automobile-centric bias in transportation policymaking. *Public Works Management & Policy, 25*(2), 167-188. doi:10.1177/1087724X19885937

Kannan, N., & Anandhi, A. (2020). Water management for sustainable food production. *Water, 12*(3), 778-785. doi:10.3390/w12030778

Kharel, G., Zheng, H., & Kirilenko, A. (2016). Can land-use change mitigate long-term flood risks in the Prairie Pothole Region? The case of Devils Lake, North Dakota, USA. *Regional Environmental Change, 16*, 2443-2456. doi:10.1007/s10113-016-0970-y

Leung, C. M., & Kwok, Y. K. (2018). Real options signaling game models for dynamic acquisition under information asymmetry. *Decisions in Economics and Finance, 41*, 35-63. doi:10.1007/s10203-018-0206-3

Li, Y., Ding, L., & Yang, Y. (2020). Can the introduction of an environmental target assessment policy improve the TFP of textile enterprises? A quasi-natural experiment based on the Huai River Basin in China. *Sustainability, 12*, 1696-1714. doi:10.3390/su12041696

Litzow, E., Neville, K. J., Johnson-King, B., & Weinthal, E. (2018). Why does industry structure matter for unconventional oil and gas development? Examining revenue sharing outcomes in North Dakota. *Energy Research & Social Science, 44*, 371-384. doi:10.1016/j.erss.2018.05.006

Luchtenberg, K. F., Seiler, M. J., & Sun, H. (2019). Listing agent signals: Does a picture paint a thousand words? *The Journal of Real Estate Finance and Economics, 59*, 617-648. doi:10.1007/s11146-018-9674-z

Maerlender, A., Palamara, J., & Lichtenstein, J. (2020). The Global Assessment of School Functioning (GASF): Criterion validity and interrater reliability. *Pyschology in Schools, 57*(6), 990-998. doi:10.1002/pits.22365

Miljkovic, D., & Ripplinger, D. (2016). Labor market impacts of U.S. tight oil development: The case of the Bakken. *Energy Economics, 60*, 306-312. doi:10.1016/j.eneco.2016.10.007

Munasib, A., & Rickman, D. S. (2015). Regional economic impacts of the shale gas and tight oil boom: A synthetic control analysis. *Regional Science and Urban Economics, 50*, 1-17. doi:10.1016/j.regsciurbeco.2014.10.006

Neubauer, A. B., Voelkle, M. C., Voss, A., & Mertens, U. K. (2020). Estimating reliability of within-person couplings in a multilevel framework. *Journal of Personality Assessment , 102*(1), 10-21. doi:10.1080/00223891.2018.1521418

Nwogu, E. C., Iwueze, I. S., & Nlebedim, V. U. (2016). Some tests for seasonality in time series data . *Journal of Modern Applied Statistical Methods, 15*(2), 382-399. doi:10.22237/jmasm/1478002920

O'Hara, J. K. (2017). Community banks and agricultural sales in rural states. *The Review of Regional Studies, 47*, 137-152.

Oke, O., Huppmann, D., Marshall, M., Poulton, R., & Siddiqui, S. (2019). Multimodal transporation flows in energy networks with an application to crude oil markets. *Networks and Spatial Economics, 19*, 521-555. doi:10.1007/s11067-018-9387-0

Ortiz, L. V. (2016). No Train No Grain: The impact of increased demand for rail services by the energy sector on wheat prices - A preliminary analysis. *International Journal of Food and Agricultural Economics, 4*(3), 103-125. Retrieved from https://www.foodandagriculturejournal.com/vol4.no3.pp103.pdf

Pallares, F. J., & Adkisson, R. V. (2017). The impact of industrial diversification on employment grouth in the 50 U.S. States: 2000-2013. *Economic Development Quarterly, 31*(4), 275-284. doi:10.1177/0891242417731599

Pei, P., Korom, S. F., Ling, K., & Nasah, J. (2016). Cost comparison of syngas production from natural gas conversion and underground coal gasification. *Mitigation and Adaptation Strategies for Global Change, 21*, 629-643. doi:10.1007/s11027-014-9588-x

Prager, D. L., Foltz, J. D., & Barham, B. L. (2015). Making time for agricultural and life science research: Technical change and productivity gains . *American Journal of Agricultural Economics, 97*(3), 743-761. doi:10.1093/ajae/aau089

Rickman, D. S., Wang, H., & Winters, J. V. (2017). Is shale development drilling holes in the human capital pipeline? *Energy Economics, 62*, 283-290. doi:10.1016/j.eneco.2016.12.013

Rodgers, R., & Joyce, P. (1996). The effect of underforecasting on the accuracy of revenue forecasts by state governments. *Public Administrative Review, 56*(1), 48-56. Retrieved from https://www.jstor.org/stable/3110053?seq=1

Salari, M., & Javid, R. J. (2016). Residential energy demand in the United States: Analysis using static and dynamic approaches. *Energy Policy, 98*, 637-649. doi:10.1016/j.enpol.2016.09.041

Shaffer, D. F. (2015). Higher education systems are assuming a larger role in the economic development efforts of their states. *Economics, Management and Financial Markets, 10*(1), 54-79. Retrieved from https://www.questia.com/library/p439438/economics-management-and-financial-markets

Sharifzadeh, M., Garcia, M. C., & Shah, N. (2015). Supply chain network design and operation: Systematic decision-making for centralized, distributed, and mobile biofuel production using mixed integer linear programming (MILP) under uncertainty. *Biomass and Bioenergy, 81*, 401-414. doi:10.1016/j.biombioe.2015.07.026

Stentoft, J., Mikkelsen, O. S., & Jensen, J. K. (2016). Flexicurity and relocation of manufacturing. *Operations Management Research, 9*, 133-144. doi:10.1007/s12063-016-0110-3

Stokan, E. J. (2019). An estimate of the local economic impact of state-level earned income tax credits . *Economic Development Quarterly, 33*(3), 170-186. doi:10.1177/0891242419858412

Turner, M., Bowen, P., Ryan, J., & Hayes, P. (2020). Development and validity of a resilience at secondary school scale. *Australian Journal of Education, 64*(1), 40-53. doi:10.1177/0004944119895818

U.S. Department of Commerce. (2020, May 12). *BEA Data*. Retrieved from Bureau of Economic Analysis: https://www.bea.gov/data

Wang, S. L., Nehring, R., & Williams, R. (2019). *Climate change likely to have uneven impacts on agricultural productivity.* Washington, D.C.: United States Department of Agriculture Economic Research Service. Retrieved from https://www.ers.usda.gov/amber-waves/2019/august/climate-change-likely-to-have-uneven-impacts-on-agricultural-productivity/

Wang, T., Jin, H., Kasu, B. B., Jacquet, J., & Kumar, S. (2019). Soil conservation practice adoption in the northern great plains: Economic versus stewardship motivations. *Journal of Agricultural and Resource Economics, 44*(2), 404-421. Retrieved from https://jareonline.org/issues/

Weijermars, R., Paradis, K., Belostrino, E., Feng, F., Lal, T., Xie, A., & Villareal, C. (2017). Re-appraisal of the Bakken Shale play: Accounting for historic and future oil prices and applying fiscal rates of North Dakota, Montana and Saskatchewan. *Energy Strategy Reviews, 16*, 68-95. doi:10.1016/j.esr.2017.02.005

Wesolowski, B. C. (2020). "Classroometrics": The validity, reliability, and fairness of classroom music assessments . *Music Educators Journal, 106*(3), 29-37. doi:10.1177/0027432119894634

Witulski, N., & G.Dias, J. (2020). The Sustainable Society Index: Its reliability and validity. *Ecological Indicators, 114*, 1-10. doi:10.1016/j.ecolind.2020.106190

Zhang, B., Cao, M., Tay, L., Luo, J., & Drasgow, F. (2020). Examining the item response process to personality measures in high-stakes situations: Issues of measurement validity and predictive validity. *Personnel Pyschology, 73*(2), 305-332. doi:10.1111/peps.12353

Zhang, R. (2018). Exposure to the new wave of offshoring: An unemployment perspective. *World Economy, 41*(6), 1722-1746. doi:10.1111/twec.12600

Zhang, S. (2019). Rethinking U.S. enterprise zones: The role of research design in program evaluation. *Local Economy, 34*(6), 545-571. doi:10.1177/0269094219871955

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Table 1
Descriptive Statistics for the Δ in Total Employees in ND Manufacturing

Variable	Obs.	Mean	Std. Dev.	Min	Max	1%	99%	Skewness	Kurtosis
Change in ND Mfg.	20	.06	.089	-.122	.257	-.122	.257	.036	3.268

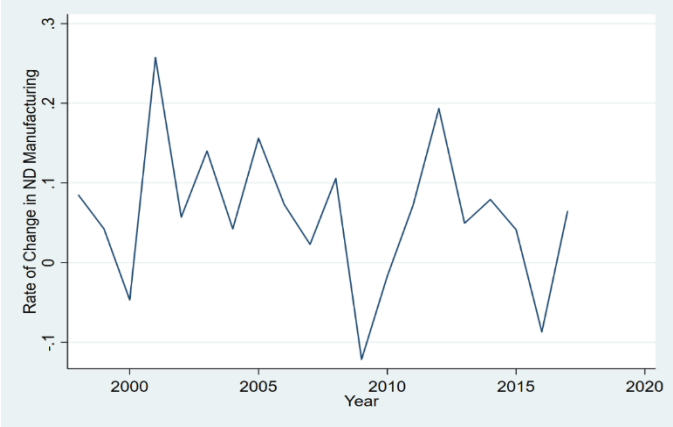

FIGURE 9: RATE OF CHANGE IN TOTAL EMPLOYEES IN THE ND MANUFACTURING SECTOR

Table 2
Descriptive Statistics for the Δ in Total Employees in ND Energy

Variable	Obs.	Mean	Std. Dev.	Min	Max	1%	99%	Skewness	Kurtosis
Change in ND Energy	20	.13	.246	-.364	.607	-.364	.607	.07	2.855

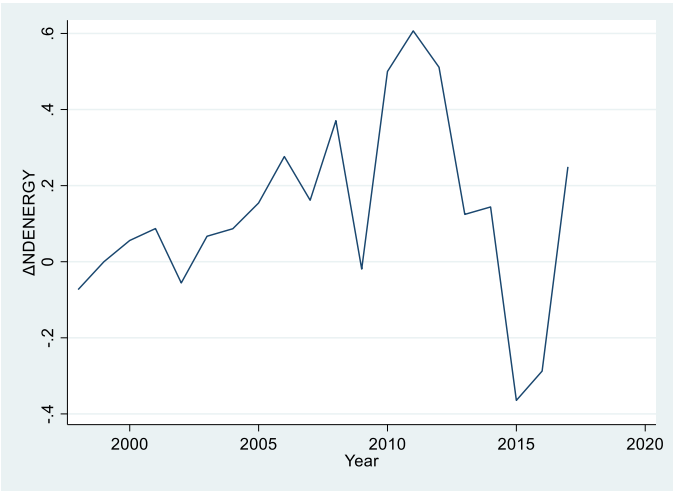

FIGURE 10: RATE OF CHANGE IN TOTAL EMPLOYEES IN THE ND ENERGY SECTOR

Table 3
Descriptive Statistics for the Δ in Total Employees in ND Transportation

Variable	Obs.	Mean	Std. Dev.	Min	Max	1%	99%	Skewness	Kurtosis
Change in ND Transport	20	.06	.076	-.121	.234	-.121	.234	.083	3.86

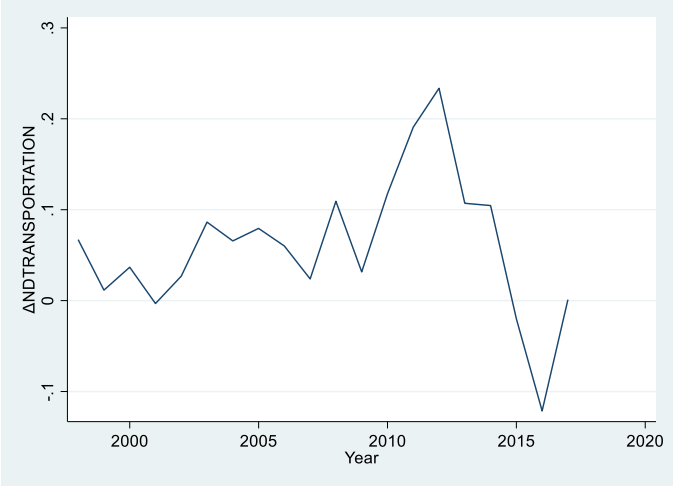

FIGURE 11: RATE OF CHANGE IN TOTAL EMPLOYEES IN THE ND TRANSPORTATION SECTOR

Table 4
Descriptive Statistics for the Δ in Total Employees in ND Agriculture

Variable	Obs.	Mean	Std. Dev.	Min	Max	1%	99%	Skewness	Kurtosis
Change in ND Agriculture	20	.09	.29	-.395	.631	-.395	.631	.45	2.416

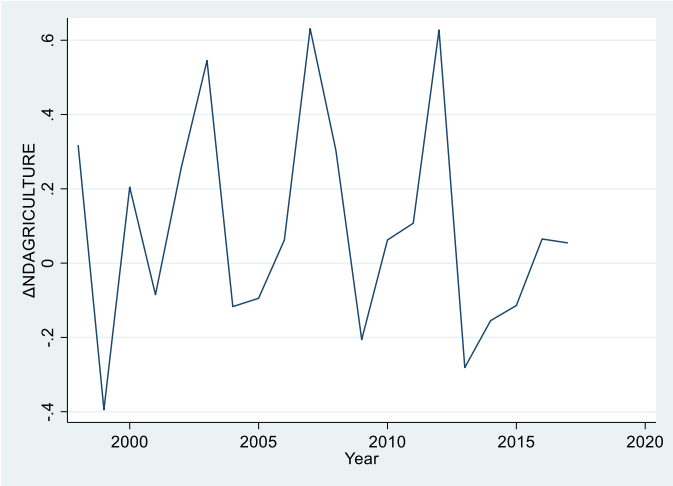

FIGURE 12: RATE OF CHANGE IN TOTAL EMPLOYEES IN THE ND AGRICULTURE SECTOR

Table 5
Descriptive Statistics for the Δ in Total Employees in ND Life Services

Variable	Obs.	Mean	Std. Dev.	Min	Max	1%	99%	Skewness	Kurtosis
Change in ND LS	20	.062	.034	-.014	.141	-.014	.141	-.018	3.636

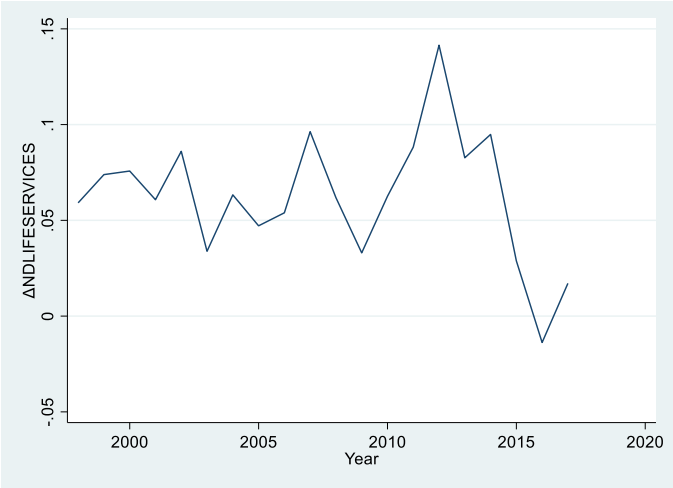

FIGURE 13: RATE OF CHANGE IN TOTAL EMPLOYEES IN THE ND LIFE SERVICES SECTOR

Table 6
Descriptive Statistics for the Δ in ND Gross State Product

Variable	Obs.	Mean	Std. Dev.	Min	Max	1%	99%	Skewness	Kurtosis
Change in ND GSP	20	.055	.067	-.083	.219	-.083	.219	.005	4.097

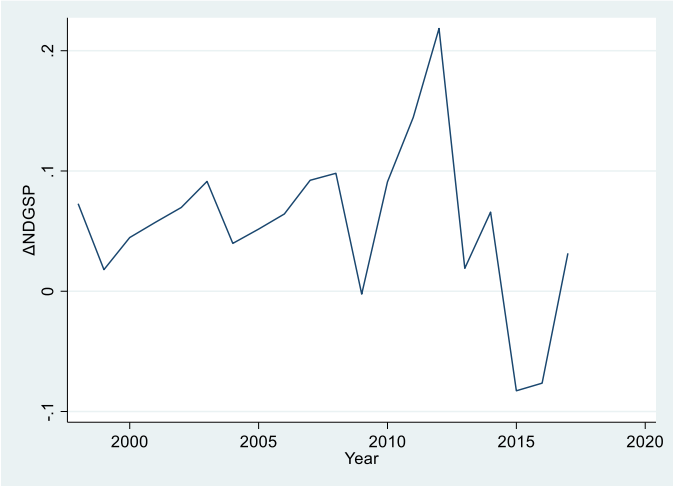

FIGURE 14: RATE OF CHANGE IN ND GROSS STATE PRODUCT

Table 7
Pairwise Correlation Among Research Variables, α = .05

Variables	ΔND GSP	ΔND Manufacturing	ΔND Energy	ΔND Transportation	ΔND Agriculture	ΔND Life Services
Rate of Change in the ΔND Gross State Product	1.000					
ΔND Manufacturing	0.524**	1.000				
ΔND Energy	0.826***	0.321	1.000			
ΔND Transportation	0.845***	0.404*	0.803***	1.000		
ΔND Agriculture	0.600***	0.230	0.278	0.292	1.000	
ΔND Life Services	0.756***	0.369*	0.543**	0.731***	0.293	1.000

**** p<0.01, ** p<0.05, * p<0.1*

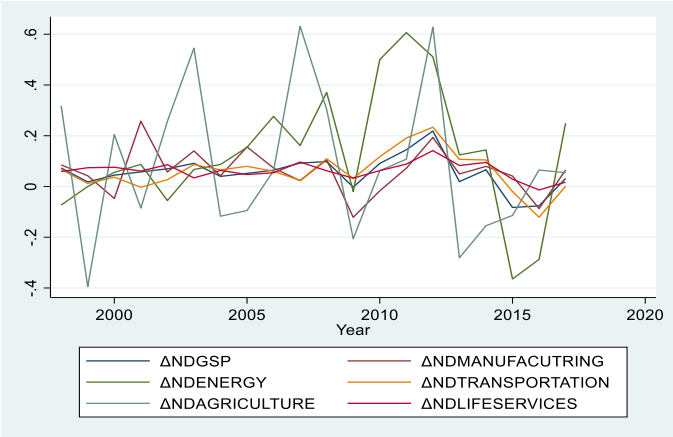

FIGURE 15: RATES OF CHANGE FOR INDEPENDENT & DEPENDENT RESEARCH VARIABLES

Table 8
Change in ND Gross State Product Regression Analyses

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Rate of Change of the change in ND Gross State Product						Robust
Change in ND Manufacturing	0.393**					0.115**	0.115***
	(0.151)					(0.0479)	(0.0386)
Change in ND Energy		0.224***				0.111***	0.111**
		(0.0359)				(0.0264)	(0.0373)
Change in ND Transportation			0.737***			0.150	0.150
			(0.110)			(0.105)	(0.116)
Change in ND Agriculture				0.138***		0.0748***	0.0748***
				(0.0433)		(0.0141)	(0.0144)
Change in ND Life Services					1.503***	0.509**	0.509***
					(0.307)	(0.171)	(0.156)
Constant	0.0317*	0.0264**	0.0109	0.0431***	-0.0383*	-0.0134	-0.0134
	(0.0159)	(0.00980)	(0.0105)	(0.0129)	(0.0216)	(0.00872)	(0.00820)

Observations	20	20	20	20	20	20	20
Adjusted R-squared	0.235	0.665	0.699	0.325	0.548	0.937	0.937
F-Stat	6.827	38.78	45.12	10.13	24.05	57.56	135.9
Prob > *F*	0.0176	7.09e-06	2.68e-06	0.00515	0.000114	7.74e-09	0
Degrees of Freedom	18	18	18	18	18	14	14

Note: Standard errors in parentheses, *** *p<0.01, ** p<0.05, * p<0.1*

Table 9
Interpolated Dickey-Fuller test for unit root

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-4.665	-3.750	-3.000	-2.630

N = 19; MacKinnon approximate *p*-value for *Z*(t) = 0.0001

Table 10
Portmanteau's Test for White Nose

Portmanteau (Q) statistic	8.795
Probability > χ^2	.3599

Table 11
ARIMA Test

ΔNDGSP	Coef.	St. Err.	t-value	p-value	[95% Conf	Interval]	Sig
ΔNDMANUFACUTRING	0.115	0.060	1.92	0.054	-0.002	0.233	*
ΔNDENERGY	0.111	0.035	3.18	0.001	0.042	0.179	***
ΔNDTRANSPORTATION	0.150	0.123	1.23	0.221	-0.090	0.391	
ΔNDAGRICULTURE	0.075	0.013	5.72	0.000	0.049	0.100	***
ΔNDLIFESERVICES	0.509	0.200	2.55	0.011	0.118	0.901	**
Constant	-0.013	0.014	-0.99	0.322	-0.040	0.013	
Sigma	0.014	0.003	4.44	0.000	0.008	0.020	***

Mean dependent variable	0.055	SD dependent variable	0.067
Number of observations	20.000	Chi-square (χ^2)	209.906
Prob > chi2	0.000	Akaike criterion (AIC)	-100.002

*** *p<0.01, ** p<0.05, * p<0.1*

THEORETICAL RELEVANCE FOR WORKING MOTHERS

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ABSTRACT

Women started entering the job market at the turn of the twentieth century as a demand arose during World War II. Women in the workforce had become a new ideal, and the challenges to balance work and home life began to present itself. The demographic shift was substantial, "between 1975 and 2009 when the labor force rate of mothers with children under age eighteen increased from 47.4 percent to 71.6 percent" (Bianchi, 2001, p.15). Although there has been an increase of women, there is still a societal belief on the role they should play and inequities that continue to plague the workforce. A working mother often requires special accommodations during the time of her children's youth, but then gives back to the organization due to gratification. "Over the course of a work life, most individuals will experience a wide range of work and nonwork identity transitions" (Ladge, Clair, & Greenberg, 2012, p.1449). If a manager can effectively work with an employee by implementing the right motivational tools during different periods of their life, it can lead to higher performance and development in the future. This paper will comprise of career development and motivational theories; along with contemporary drivers pertaining to working women relating to workforce education that are tied to current culture, policies, and training procedures within an organization.

INTRODUCTION

Pressing Issue Women in the Workplace

The entrance of women in the workplace in the last five decades has resulted in dramatic increases, due to societal changes in relation to social, economic, and personal reasons (Gordon, 2014). Many changes have taken place over the past half-century, Bianchi (2001) notes that both traditional family and workplace practices have drastically changed. This is seen through research that was conducted by Bianchi (2001) that found how family ideals have changed with the increase of mothers working outside the home. With these changes comes the demand of accommodating women entering the workforce with occupational preparedness through careful analysis of employment selection, motivational factors, and satisfaction.

With the increase of women within federally supported public sectors there has been a political change through the Title XI of the Education Amendment of 1972, that was passed to prohibit sex discrimination (Gordon, 2014). Unfortunately, it was not until 1976, that "sex equity provisions were established in the vocational education section of the Education Amendments" (Gordon, 2014, p. 158). The demographic shift of more women entering the workforce led to a continued interest for women in careers that were dominated by males, which led to inevitable discrimination. The discrimination in male perceived professions continues today in the education system. Dresden, Dresden, Ridge, & Yamawaki (2017) found that men from male dominated majors displayed biases towards women within the same profession. This male egocentric mentality created gender harassment within these majors in contrast to the disciplines primarily pursued by females. Women that chose a major that was not dominated by men did not have to face the same harassment as the women who chose a male dominated major. The occupations that are primarily comprised of male counterparts, women continue to struggle for advancement (Ballakrishnen, Fielding-Singh, & Magliozzi, 2018). "Among CTE programs, business, cosmetology, health occupations, and home economics have been the domain of women; agriculture, auto mechanics, building trades, and technology education have been areas considered appropriate for men" (Gordon, 2014, p. 159).

Unfortunately, this perceived mentality follows the women to their career, which is primarily made up of males. They continue to face harassment on their ability to perform the job and an intolerance to technological advances offering flexible work arrangements for working mothers. When entering a career primarily made up of men from a global perspective, there is not always an understanding of the gender differences and equitable contributions that can be made by both parties. "Informal workplace interactions are powerful organizational processes producing inequalities in male-dominated work, where sexuality is frequently employed as a means of control over women" (Wright, 2016, p. 348). Men that fall into this category tend to feel inferior if they are the minority and are less likely to harass the women, but if the woman is a minority they are more prone to harassment if their male colleagues believe it is not where they belong. The laws that have been passed to protect women from this harassment has not halted society from offering unequal opportunities or cultural acceptance, leading to a continued sexual division in the workplace. In lieu of the progress that women have made in discovering the right career in the new economy, there is still a

struggle of division in male-dominated occupations (Gordon, 2014). According to Jacobs & Hawley (2009) there are five specific drivers that impact the field and play a valuable role in driving and impacting education, training, and development. These five drivers include: "(1) globalization; (2) technology; (3) the new economy; (4) political change; and (5) demographic shifts." The impact and effects of these five drivers relate to multiple pressing issues, including women within the workplace. The following outline will explain the influence these drivers have and effective theories that can provide a course of action that can be implemented within an organization to lead to favorable results in effectively managing women.

ACTION PLAN OUTLINE

New Economy - Trait and Factor Theory

The trait-and-factory theory is beneficial for women seeking an occupation that fits her current or expected life condition. A trait represents a characteristic of the woman that distinguishes her from others through her unique attributes. Career counseling can assist women in managing their career through human capital, while taking into consideration career goals and potential life changes. In finding a natural fit for personal characteristics based on the occupational requirements, a woman with children can choose an accommodative career for their personal life and aspirations. Relating ones interests and values to discover the right career path can lead to an appropriate career fit and a more pleasurable work experience. In making a cognitive and conscious choice in career selection, it will ideally lead to better job performance and success (Gray & Herr, 1998). CTE has played a valuable role by helping women seeking a career to find a match to accommodating industrial positions (Gordon, 2014). Having the right career can protect a working mother from challenges that may be encountered in other professions that are as accommodating to the desired lifestyle. According to Hamilton, et al., there is a decrease of 2% from 2017 in the US birth rate, which is the lowest number of births in 32 years. This decline is reflected through global demographics and can lead to critical issues within the next few decades if the birth rates continue to decline in developed countries. "Over the next thirty years, most developed countries are going to be faced with increasing numbers of individuals receiving retirement benefits and decreasing numbers of individuals actually working and making contributions to retirement accounts" (Jacobs & Hawley, 2009, p. 2540). Therefore, introducing women to a career that is a good fit for them and their personal life can increase the chances of motherhood.

Technology - Engagement Theory

Leaders who show a genuine interest in employees and find ways to develop and encourage them are rewarded with a loyalty that brings about full engagement. Therefore, leaders are encouraged to customize their approach to engagement at the individual level. Conkright (2015) acknowledges the importance of recognizing individuality within the organizations culture to implement applicable engagement strategies. This can be beneficial to working mothers who require flexible work arrangements. A manager can receive more favorable results from a working mother if willing to accommodate to the female employee's recent life change. This can be accomplished through a variety of incentives, such as maternity leave, telecommuting, part-time opportunities, and on-site childcare. Productivity can be maximized with the appropriate work environment, schedule, and acknowledgment of interests.

A one-size-fits-all approach is not an option when working with employees to gain full engagement. Through proper education and training a manager can learn effective ways to manage appropriately on an individual basis. The key is to seek to find universal factors, then help managers interpret what is discovered at an individual level (Conkright, 2015). Leaders within an organization can "promote and motivate followers by projecting and communicating attractive visions, common goals and shared values as well as by setting an example for the requested behavior" (Conkright, 2015, p.18). In having open communication and setting clear goals and objectives an employee knows what is expected of them and can plan accordingly with meeting those goals. According to research conducted by Conkright (2015) employees perceive engagement as empowerment from management to work in an autonomous environment through faith in the employees' ability to achieve a positive organizational outcome. It takes a great deal of effort for a leader and an employee to develop a trustworthy relationship, allowing the employee to be self-delegated on tasks that need to be performed through "sustainable engagement" (Conkright, 2015, p.20).

Technological advances have helped women on maternity leave to return to work part-time or work from home to meet her job requirements, but still have an active role within their family life. Technology has provided an opportunity in the workforce to use innovative strategies to help individuals embrace changes, while pursuing a healthy

work-life balance. It has played a valuable role in providing opportunities for women to continue learning and working after having a baby in the comfort of their own home, while accommodating their busy schedule. Due to different life circumstances, flexible arrangements for working mothers can help them achieve meeting their requirements along with special gratitude for the accommodations offered to them. "Employees who obtain economic and socioemotional resources in the workplace tend to feel obligated to repay the supervisor or organization via their positive attitudes and behaviors" (Hsieh & Wang, 2015, p. 2333). Therefore, working with mothers to achieve their career aspirations and fulfil their role both within the home and work, will lead to greater productivity and lower turnover rates.

Political Change- Attribution and Motivational-Hygiene Theory

This theory has influenced CTE to pair students with job positions that lead to achieving a meaningful existence through Herzberg's motivational theories (Gordon, 2014). Herzberg's motivational theories works collaboratively with the efforts of CTE in offering an opportunity for training and developing employees for advancement. In creating the right environment for an employee, they will be motivated to turn their skills into behaviors to achieve higher performance. The manager can achieve this by creating a positive work environment where employees enjoy coming to work. Motivation is a key element in generating satisfactory employee performance to meet goals. An employee needs to be motivated to use their skills to meet the requirements of the organization (Cakir & Kozak, 2017). Through finding the employees strengths and building off of them, it will make them feel valuable and result in enhanced productivity for the organization.

CTE, unlike other disciplines in education, "more definitively satisfies Herzbergs (1966) notion that the primary function of any organization should be employment and the need for man to enjoy meaningful existence" (Gordon, 2014, p. 155). Therefore, it is important to create an environment for a working mother where she can grow in her career, while being given the opportunity to fulfil her motherly role as well. Although, this is not always an option due to inequity and biases that still plagues the workforce today.

In addition to teaching career skills, CTE has worked to eliminate the gender biases that lead to a hostile work environment. "It is this purpose of connecting school and work that makes CTE an important focus for equity in the workplace" (Gordon, 2014, p. 155). Sex discrimination denies women of opportunities, status, and rewards, leading to unfavorable environment (Gordon, 2014). Political change has included both the behavioral and social sciences of inclusion through "building trust and involving the community in the development and implementation of environmental policies, and the development of laws and regulations required for advancing controversial topics" (Hur, Andalib, Maurer, Hawley, & Ghaffarzadegan, 2017, p. 1-2). Dresden et al. (2017) describes that women entering a male-dominated career increases the chances of being sexually harassed. There have been laws set in place that need to be acknowledged and enforced to condone sexual harassment within the workplace. "The legal definition of sexual harassment as a construct has two forms: (1) quid pro quo (QPCJ) sexual harassment, involving threats to make employment-related decisions such as hiring, promotion, and termination on the basis of target compliance, and (2) hostile work environment sexual harassment, defined as sex-related conduct that unreasonably interferes with an individual's work performance or creates an intimidating, hostile, or offensive working environment" (Mainiero & Jone, 2013, p. 190).

In improving the hygiene factors by having a healthy work environment with equal opportunities and treatment, job dissatisfaction decreases. Park et al., 2015 discusses how an employee's psychological condition directly impacts their performance and level of motivation. In improving the hygiene factors through company incentives, such as strategies suggested by Gordon (2014) including mentoring programs, female role models, equal treatment, and proper training there can be an increase in job satisfaction and performance. This can be honed to each specific case including working mothers that would benefit from on-site childcare, flexible work arrangements, job sharing, and programs offered to assist in career progression (Michailidis, Morphitou, & Theophylatou, 2012). According to Herzberg's Theory, these motivators can be seen as an opportunity resulting in job satisfaction.

Globalization/Demographic Shifts- Organizational Theory

Organizational theories provide researchers with new and beneficial information on the relationships between the organization and the environment. This theory is beneficial to human resource development throughout a global perspective due to the important dynamics created by each employee in the formation of organizational attributes such as policies, procedures, and work expectations, and cultural norms. These all have a valuable impact on a diverse

group, including women who require additional needs specifically during childbearing years. Globalization has increased the need for understanding of these cultural differences and the inclusion of women in different demographics. CTE is a valuable resource in offering international curriculums to accommodate people of diverse backgrounds and provide globalized efforts of inclusion (Gordon, 2014). Building rapport within the organization through the sharing of information, performance enhancement, and proper human resource criterion can strengthen workplace relationships, in turn leading to a better work environment and organizational success (Greenwood & Miller, 2010). An analysis of an organization can be conducted by acknowledging how an employee perceives and responds to an event, how vested they are, and their common work practices (Bechky, 2011). Understanding organizational life can better equip managers to work with women on an international basis, and assist in their concerns. It can also open doors to developing a training plan that is specific to the organizational culture and allow the opportunity to discuss twenty-first century skills on the value of inclusion. Through this initiative organizations can develop employees by implementing a productive learning environment, and specifically hone it to accommodate diverse groups. Gordon (2014) discusses the value in foreign exchange programs to educate on modern norms of inclusion and common workplace practices. A transformational leadership approach can be adopted to encourage managers to "work creatively and imaginatively" with their employees (Bechky, 2011, p. 1162). "Transformational leadership influences organizational performance positively through organizational learning and innovation" (Garcia-Morales, Jimenez-Barrionuevo, & Gutierrez-Gutierrez, 2012, p.1040). In following a form of transformational leadership among the organization "there is a positive correlation associated with organizational commitment and work engagement" (Conkright, 2015, p.18). Therefore, organizational theory looks at the way the organization operates as a whole, specific to employee situations and outcomes; while globalization creates an opportunity for inclusion and a commonality in workplace practices. Sustainability in an ever-changing market begins with effective communication within the organization to apply principles of engagement to daily decision making and behaviors (Conkright, 2015, p. 18). The need to work with women within from a global perspective within the workplace is starting to show based on a recent demographic shifts. "The American workforce has grown by more than 50% over the past twenty years, but will see a substantial decline over the next few decades" (Jacobs & Hawley, 2009, p. 2542). Countries such as a China are facing a decrease in workforce with their policies on childbearing, while less developed countries are becoming more populous but not producing qualified workers. An organization that values their employees' needs to work with each one of them on an individual level accommodating their needs; specifically towards working women and their impact on society.

CONCLUSION

Workforce Education Relevance

As the demographic shift of more women entering the workforce takes place, there is still a misconceived persona that they belong in the home when tending to children. Looking back to World War I and II, when women began working in factories to make up for the industrial expansion, the prevalence of a women entering a course of study in vocations tended to accommodate to their role as a homemaker, following a more domestic approach became the norm (Gordon, 2014). A vocational education has come a long way since the middle of the twentieth century, but there are still areas for improvement and political change in gender biases. It all starts with global and societal changes in the views of gender equality and acceptance. In gaining awareness around equality and adaption to cultural, political, and demographic shifts our society as a whole can benefit from effective training through CTE and within the workplace.

Professional Knowledge Gained

Following the principles of the theories and drivers mentioned is a step in the right direction for eliminating gender biases and leading to a stronger workforce by accommodating women with occupational preparedness, factor analysis in employment selection, motivational techniques, and equitable working conditions. This will prove to be invaluable in future research interests and career endeavors.

REFERENCES

Ballakrishnen, S., Fielding-Singh, P., & Magliozzi, D. (2018). Intentional invisibility: Professional women and the navigation of workplace constraints. *Sociological Perspectives, 62*(1), 23-41. doi:10.1177/0731121418782185

Bechky, B. A. (2011). Making organizational theory work: Institutions, occupations, and negotiated orders. *Organization Science*, *22*(5), 1157–1167. doi: 10.1287/orsc.1100.0603

Bianchi, S. M. (2011). Changing families, changing workplaces. *The Future of Children, 21*(2), 15-36. doi:10.1353/foc.2011.0013

Çakır, O., & Kozak, M. A. (2017). Designing an effective organizational employee motivation system based on ABCD model for hotel establishments. *Tourism and Hospitality Management*, *23*(1), 69-86. doi:10.20867/thm.23.1.6

Conkright, T. A. (2015). Using the four functions of management for sustainable employee engagement. *Performance Improvement*, *54*(8), 15-21. doi:10.1002/pfi.21506

Dresden, B. E., Dresden, A. Y., Ridge, R. D., & Yamawaki, N. (2017). No girls allowed: Women in male-dominated majors experience increased gender harassment and bias. *Psychological Reports, 121*(3), 459-474. doi:10.1177/0033294117730357

García-Morales, V. J., Jiménez-Barrionuevo, M. M., & Gutiérrez-Gutiérrez, L. (2012). Transformational leadership influence on organizational performance through organizational learning and innovation. *Journal of Business Research*, *65*(7), 1040–1050. doi: 10.1016/j.jbusres.2011.03.005

Gray, K. C., & Herr, E. L. (1998). *Workforce education, the Basics*. Needham Heights, MA: Allyn Bacon.

Gordon, H. R. D. (2014). *The history and growth of career and technical education in America*. Long Grove, IL: Waveland Press, Inc.

Greenwood, R., & Miller, D. (2010). Tackling design anew: Getting back to the heart of organizational theory. *Academy of Management Perspectives*, *24*(4), 78–88. doi: 10.5465/amp.2010.55206386

Hur, H., Andalib, M. A., Maurer, J. A., Hawley, J. D., & Ghaffarzadegan, N. (2017). Recent trends in the U.S. behavioral and social sciences research (BSSR) workforce. *Plos One*, 12(2). doi: 10.1371/journal.pone.0170887

Hsieh, C., & Wang, D. (2015). Does supervisor-perceived authentic leadership influence employee work engagement through employee-perceived authentic leadership and employee trust? *The International Journal of Human Resource Management*, *26*(18), 2329-2348. doi:10.1080/09585192.2015.1025234

Jacobs R.L., Hawley J.D. (2009) The emergence of workforce development: definition, conceptual boundaries and implications. In: Maclean R., Wilson D. (eds) *International Handbook of Education for the Changing World of Work*. Springer, Dordrecht

Mainiero, L. A., & Jones, K. J. (2013). Sexual harassment versus workplace romance: Social media spillover and textual harassment in the workplace. *Academy of Management Perspectives*, *27*(3), 187-203. doi:10.5465/amp.2012.0031

Michailidis, M. P., Morphitou, R. N., & Theophylatou, I. (2012). Women at work equality versus inequality: Barriers for advancing in the workplace. *The International Journal of Human Resource Management*, *23*(20), 4231-4245. doi:10.1080/09585192.2012.66507

Park, C. H., Kim, W., & Song, J. H. (2015). The impact of ethical leadership on employees' in-role performance: The mediating effect of employees' psychological ownership. *Human Resource Development Quarterly*, *26*(4), 385-408. doi:10.1002/hrdq.21217

Wright, T. (2015). Women's experience of workplace interactions in male-dominated work: The intersections of gender, sexuality and occupational group. *Gender, Work & Organization, 23*(3), 348-362. doi:10.1111/gwao.1207

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COMPELLED ONLINE DUE TO COVID-19. PERCEPTIONS OF FIRST-TIME ONLINE STUDENTS

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ABSTRACT

In Spring 2020, colleges and universities across the globe transitioned to online learning in response to the coronavirus pandemic. Students who had enrolled in face-to-face courses were moved online, many for the first time. How this forced exposure to online learning will impact students' attitudes toward distance education is a trending topic of discussion. Some contend the conversion will accelerate adoption of online education while others believe it could hinder acceptance. While distance learning literature has examined factors that influence students' decisions to enroll in online courses and perceptions of their experiences, no studies have examined these topics in such extraordinary circumstances. The students included in this study had never taken online courses before being compelled to do so during the coronavirus pandemic. Their feedback is invaluable as universities plan their online offerings in a period of tightening budgets and retention concerns.

INTRODUCTION

In March 2020, colleges and universities across the globe transitioned to online learning in response to the coronavirus pandemic. Students who had enrolled in face-to-face courses were moved online, many for the first time. How this forced exposure to online learning will impact students' attitudes toward distance education is uncertain. Some contend the conversion will accelerate adoption of online education while others believe it could hinder acceptance (Lederman, 2020).

Distance learning literature has examined factors that influence students' decisions to enroll in online courses and perceptions of their experiences. No studies have examined these topics in such extraordinary circumstances. The students included in this study had never taken online courses before being compelled to do so during the coronavirus pandemic. Their feedback is invaluable in what Blumenstyk (2020) calls a "black swan" moment for higher education.

METHODOLOGY

Instrumentation

The instrument was designed to measure how perceived flexibility of online classes, perceived learning effectiveness of online classes, a student's self-discipline, perceived value of in-person interaction, and gender affect first-time online students' intentions to take more online classes after the coronavirus pandemic. Below are the measures included in the instrument.

- Demographic data: Gender, major, and class level
- Number of online classes taken prior to coronavirus induced transition to distance learning
- Four composite variables were constructed using the statements below where students rated their level agreement using a five-point Likert type scale ranging from 1 = strongly disagree to 5 = strongly agree:

- Flexibility
    - Online classes provide more flexibility in my schedule
    - Online classes fit my lifestyle better
    - Online classes require less time than regular classes
    - Online classes are more convenient than traditional courses

- Effectiveness of learning
    - I learn material well through online courses
    - Online classes provide deep learning experiences
    - Online classes are an effective way to learn material
    - Online classes will help prepare me well for my career

- Self-discipline
    - I am skilled in time management
    - I have the discipline/motivation to study independently without regularly scheduled in-class sessions
    - I keep up with deadlines and material without having regularly scheduled in-class sessions
    - I can focus well even if I am taking online classes at home

- Value of in-person interaction
    - In-person interaction with the instructor helps me be successful in classes
    - In-person interaction with the instructor helps me stay focused/motivated
    - In-person interaction with the instructor helps me learn more
    - In-person interaction with instructors and peers simply makes classes better

- Intention to take more online classes: Students rated their level agreement using a five-point Likert type scale ranging from 1 = strongly disagree to 5 = strongly agree: "I am interested in taking more online classes"

Data collection

The online survey was released the last week of regular classes, five weeks after classes resumed online. The sample was drawn from undergraduate students enrolled in Managerial Accounting, Intermediate Accounting, and Personal Financial Planning. The survey was anonymous. No names or unique identifiers were included on the instrument.

Data analysis

Respondents that reported taking online classes prior to the coronavirus induced transition to distance learning were excluded from the dataset. Each of the four composite variables were found to have acceptable Cronbach alphas. Descriptive statistics regarding frequencies, percentages, and means of responses were computed for each variable. Ordered logistic regression assumes that the impact of explanatory variables on the odds of the dependent variable are consistent regardless of the level. A test of Parallel Lines shows that this assumption was met ($p = .564$). Multicollinearity was tested via tolerance and variance inflation factor tests. The results indicate that the independent variables are not highly correlated with each other.

RESULTS

Demographics

Ninety-two undergraduate business students from one of the universities within Pennsylvania's State System of Higher Education were included in the sample. The mean age was 20.13 years with a standard deviation of 1.563 years. Sixty-four percent of the respondents were male, and 36 percent were female. Sophomores comprised the largest group of students (49 percent) followed by Juniors (21 percent), Freshmen (22 percent) and Seniors (9 percent). Table 1 shows frequencies and percentages for gender, major, and class level.

Table 1
Gender, major, and class level data

	Frequency	Percent
Gender		
Males	59	64
Females	33	36
Other	0	0
Major		
Accounting	31	34
Finance	11	12
Marketing	10	11
Management	21	23
International	4	4
General business	15	16
Class level		
Freshmen	20	22
Sophomore	45	49
Junior	19	21
Senior	8	9

Descriptive

A student's intention to take more online classes was measured using a five-point Likert type scale with 1 representing strongly disagree to 5 representing strongly agree. Students' perceived flexibility of online classes, perceived learning effectiveness of online classes, self-discipline, and perceived value of in-person interaction were measured through a variety of questions using five-point Likert type scales with 1 representing strongly disagree to 5 representing strongly agree. Composite variables were created from individual questions to construct four predictor variables. Table 2 shows means and standard deviations for these variables.

Table 2
Descriptive statistics

	M	SD
Intention to take more online classes	2.87	1.28
Perceived flexibility	2.96	1.10
Perceived effectiveness of learning	2.13	1.05
Self-discipline	3.41	1.09
Value of in-person interaction	4.57	0.65

Inferential statistics

An ordered logistic regression was performed to assess the relationship between first time online students' perceived flexibility of online classes, perceived learning effectiveness of online classes, self-discipline, perceived value of in-person interaction, and gender and their intention to take future online classes.

Goodness of fit was tested using the Pearson chi-square test [χ 2(347) = 257.018, p=1.00] and deviance test [χ 2(347) = 200.069, p=.1.00]. Neither were statistically significant. A Chi-Square goodness of fit test finds there is a significant difference between the observed and expected value [χ2(5) = 84.114, p<.001]. The Cox and Snell R2 and the Nagelkerke R2 measure the proportion of the variance in the dependent variance that is related to the independent variables. Number of previous online classes, perception of flexibility, perception of effectiveness of learning, self-discipline, perceived value of in-person interaction, and gender explain 59.9 to 62.6 percent of the variance in a student's intention to take more online classes.

Perceived flexibility of online classes was significantly associated with a student's intention to take more online classes. For every incremental increase in this Likert type scale, the odds ratio of 3.452 (95% CI, 2.008 to 5.934), Wald χ 2(1) = 20.099, $p < .001$ shows a student is 3.452 times more likely to be in a higher level of intention to take future online classes, while controlling for other independent variables. Perceived effectiveness of learning via online classes was significantly associated with a student's intention to take more online classes. The odds ratio of 2.392 (95% CI, 1.397 to 4.095), Wald χ 2(1) = 10.114, $p < .01$ indicates that for every one unit increase on the perceived effectiveness of learning scale, a student is 2.392 times more likely to be in a higher level of the intention to take future online classes, while controlling for other independent variables. Students' self-discipline, the degree to which they value in-person interaction, and gender did not demonstrate statistically significant associations with intention to take more online classes. Table 3 presents results of the ordered logistic regression.

Table 3
Ordered logistic regression results

	B	SE B	Wald	p	OR
Perceived flexibility	1.239	0.276	20.099	0.000	3.452
Perceived effectiveness of learning	0.872	0.274	10.114	0.001	2.392
Self-discipline	0.338	0.219	2.377	0.123	1.402
Value of in-person interaction	-0.358	0.359	0.995	0.319	0.699
Gender	-0.004	0.433	0.000	0.993	0.996

DISCUSSION

Perceived flexibility of online courses among these students was not significantly different than the neutral point on the Likert type scale (M = 2.96, SD = 1.10). This may seemingly conflict with existing research, but the respondents and circumstances are unique to this study. These students did not have prior experience with online courses and the transition from face-to-face to distance learning was involuntary. Many students expected their free time to increase through distance learning but found the workload and time required for online classes to decrease flexibility of their schedules. For example, one student said, "It just somehow feels like I have a lot more work to do than what face-to-face courses have us do". This agrees with studies that have found students generally assume online courses will require less work (Bawa, 2016; Brown, 2012).

While the mean score for perceived flexibility was not high, a significant association between perceived flexibility and the likelihood of taking future online classes was found. For every increase in the perceived flexibility Likert scale, a student is 3.452 times more likely to be in a higher level of intention to take future online classes. Consistent with literature (Daymont et al., 2011; Ilgaz & Gulbahar, 2017; Pastore & Carr-Chellman, 2009), perceived flexibility demonstrated the highest association with intention to take future online classes among all explanatory variables. Students who reported high levels of perceived flexibility said, "I like that I can do my classes at any time of day", "You aren't stuck in this schedule all semester long for on campus courses", and "It gives me more time to work and plan school based on my work schedule".

Some students indicated that they simply learn more through independent study. Others pointed to the benefits of asynchronous learning in terms of pacing: "Recorded videos allow me to re-watch if I don't get something or want to review. Then I can make sure I understand before moving on". However, the majority of students disagreed that online courses provide an effective way to learn material with a mean score significantly lower (M = 2.13, SD = .1.05) than 3.0 (neutral), t(91) = -7.905, $p < .001$. Student comments indicated they were not learning as much in the online format compared to face-to-face. One student put it this way: "I may pass these classes, but I doubt many students are learning a lot". Despite the low overall perception of learning effectiveness, this factor was significantly associated with a student's intention to take future online courses. The results show that for every increase in this scale, a student is 2.392 times more likely to be in a higher level of intention to take future online courses.

The most common open-ended feedback related to learning effectiveness and the likelihood of taking future online courses centered on a course's subject matter. Rather than writing off online courses completely, comments indicate that students are using this first online experience to inform their decisions about which courses they may be interested in taking online. One student said, "I feel that general education courses would be ok, but I want to take courses for my major in person". Many comments revealed business students do not perceive non-major courses a priority in

terms of channeling effort toward learning the material. Instead, they appear to be more concerned with acquiring the required credit hours in non-business courses. Consequently, despite the perceived deficiency in learning, business students view the online format as an efficient way to meet general education requirements.

The mean for self-discipline was higher than the neutral point on the Likert type scale but not significantly related to a student's intention to take future online courses. The most prevalent comments submitted by students explaining why their interest in online classes had decreased related to self-discipline and motivation. Below are examples:

- *"I tend to wander off and put my work on the back burner"*
- *"It's harder to find the motivation to get on the computer and do the work"*
- *"Being at home makes it seem like assignments are not as important"*
- *My motivation dropped to an all-time low because of distractions and no set schedule"*

This is concerning because research consistently shows that self-regulation improves academic performance (Efklides, 2011; Mega et al., 2014) and self-discipline is positively correlated with retention in online courses (Heyman, 2010; Nichols, 2010). The students in this study had not taken online courses prior to the compulsory enrollment due to the coronavirus pandemic. Their responses agree with Bawa's (2016) contention that students who are not familiar with the level of self-discipline required in online learning can become demotivated. Some comments that cited self-discipline issues in the online format also noted how the absence of in-person sessions compounded their lack of motivation: "I have realized that being forced to go to actual face-to-face classes helps me stay motivated". Further research should explore the mediating effect of regularly scheduled class sessions (face-to-face and synchronous online) on student motivation.

While in-person interaction was not significantly related to a student's intention to take future online classes, students strongly agreed that in-person interaction helps them learn more. The mean score for this composite variable was of 4.57 (SD = 0.65) on the 5-point Likert type scale. Students said "I absolutely learn more and retain more information with face-to-face classes", "I realized how much I've taken for granted going to class. I thought I was going to love staying at home and doing online classes but I've since realized how much going to class in person benefits me", and "I learn more in the classroom and definitely prefer that format". Consistent with existing studies, these students report learning advantages in face-to-face courses (Daymont et al., 2011; O'Neill & Sai, 2014).

While not included in the survey instrument as an independent variable, a few student comments revealed that their interest in online courses has increased due to health and safety concerns. Although health experts are still researching various modes of transmission, the Center for Disease Control and Prevention (CDC) is confident that the virus spreads through respiratory and contact transmission (CDC, n.d.). Hence, its recommendation to maintain a 6-foot distance between individuals. Concerns abound about how safety issues will affect students' decisions regarding course format and higher education in general. More research needs conducted in this area to assess how students' health and safety concerns are impacting their educational courses.

It is an unprecedented role which the students in this study have assumed. Existing studies have examined factors that influence students' decisions to take online courses, as well as first-time online students' perceptions of their experiences. This study is unique in that these first-time online students were compelled to engage in distance education. Blumenstyk (2020) contends that the coronavirus could be a "black swan" moment for higher education where colleges and universities will be required to "rethink how they operate on every level". In a piece published in Inside Higher Ed shortly after the nationwide conversion to online courses, Lederman (2020) compiled responses from experts about the "forced exposure" to online learning and what it may mean for online learning. Some experts assert that the compulsory conversation to online will accelerate adoption among both students and faculty. Other experts are skeptical. These individuals point to how many students' first exposure to online learning is occurring with mediocre online courses. Consequently, these experts believe this experience could negatively affect students' attitudes toward this format. Krupnick (2020) agrees with this sentiment by pointing to the difference in quality between classes originally designed for online and those converted from face-to-face formats in a hurried manner. As Li & Akins (2004) noted long before the pandemic, traditional courses cannot be directly translated to online courses.

Considering the nonideal transition from face-to-face courses coupled with the already high attrition rates among online students (Bawa, 2016), what actions can be taken? While it is understood that online courses require superior organization and structure (Sharoff, 2019), this was not emphasized by students in this study. Many institutions will

need to heavily invest in technology and related training to improve the quality of their online offerings (Lederman, 2020) but no students in this study or recent articles cited this as impacting their intentions to take future online courses. Accordingly, the following concentrates on three factors that will positively impact student motivation and retention in a timely and cost-effective manner.

First is the solicitation of student feedback. This study contributes to that end. Input from these first-time online students provides a unique perspective on distance learning because their expectations and experience during the first half of the semester were grounded in learning in a face-to-face environment. Encouraging feedback from these students was a common recommendation among the experts included in Lederman's (2020) compilation. This is consistent with studies prior to the coronavirus which found solicitation of student feedback to be an important component of effective online teaching (Jaggars & Xu, 2016; Sharoff, 2019). Young (2006) finds that requesting student feedback not only helps online instructors improve their course but it also improves students' perceptions of instructors' effectiveness.

The second recommendation pertains to feedback from instructors. Mantravadi and Snider (2017) call feedback "the life blood of online courses" (p. 108). Communication for the sake of communicating is not effective. The type of communication matters. Mantravadi and Snider (2017) believe spending more time grading and providing individual formative feedback is more effective in increasing student motivation as opposed to encouraging students to engage with a course. Fryer and Bovee (2016) find that instructors have the ability to affect motivational issues by clearly communicating the relevance of assignments to online students. Swafford (2018) found similar results in a study that found task value to be significantly related to self-regulated learning online. Task value refers to the degree to which students perceive meaningfulness of an assignment (Swafford, 2018). This author emphasized that not only do educators need to be conscientious in constructing relevant assignments, but they must also explicitly communicate why the assignments are meaningful to help students make the connection.

The third and seemingly most important factor is instructor-student interaction. Students in this study reported that the lack of interaction via face-to-face class sessions negatively affected their motivation in their online courses. Krupnick's (2020) article also cites students complaining of instructors simply posting material on learning management systems with no interaction. Highly interactive instructors respond to student emails quickly (Jaggars & Xu, 2016; Sharoff, 2019) and use synchronous online class sessions and office hours to interact with students (Lederman, 2020). Jaggars and Xu (2016) find that interactions between instructor and students enhances student commitment, motivation, and positively correlates to student grades. They contend this is the key to delivering effective online courses.

A common theme emerges from the three recommendations discussed above: instructor engagement is paramount in delivering effective online courses. It strengthens students' connections to online courses (Jaggars & Xu, 2016; Young, 2006), positively affects student motivation (Fryer & Bovee, 2016; Jaggars & Xu, 2016), and improves retention (Mantravadi & Snider, 2017).

This study provides a unique contribution to distance learning literature. Existing studies have examined factors that influence students' choices of course format and perceptions of their experiences but none have examined these topics in such an unparalleled circumstance.

In this study, first-time online students' intentions to take future online classes varied with a mean score near the neutral point. Consistent with existing literature, a significant association was found between perceived flexibility and likelihood to take future online courses. A significant association was also found between perceived effectiveness of learning online and intention to take future online courses. It does not appear this experience has prompted these students to rule out online courses completely or propel them to enroll exclusively in online classes. Instead, students indicate they are more interested in taking online courses that are outside of their major. This was driven by their unfavorable perceptions of learning effectiveness via online courses. Self-discipline was not associated with intention to take future online courses, but students readily acknowledged that their motivation declined after face-to-face classes were converted to distance education. Many point to the absence of in-person interaction as the source for their motivational decline.

Opinions vary about how this forced exposure to online learning will impact students' perceptions of distance learning and their intentions to take future online classes. There will certainly be discussions about how to best allocate

universities' limited resources. While institutions must continue to invest in technology, course design, and support services, student feedback from this study reminds stakeholders about the critical role of the online instructor in student learning and motivation. Online educators must be intentional about simulating the type of in-person interaction that these first-time online students reportedly want and need.

REFERENCES

Bawa, P. (2016). Retention in online courses: Exploring issues and solutions - A literature review. *SAGE Open*, January-May, 1–11. https://journals.sagepub.com/doi/pdf/10.1177/2158244015621777

Blumenstyk, G. (2020, March 11). Why coronavirus looks like a "black swan" moment for higher ed. *The Chronicle of Higher Education*. https://www.chronicle.com/article/Why-Coronavirus-Looks-Like-a/248219

Brown, J. (2012). Online learning: A comparison of web-based and land-based courses. *Quarterly Review of Distance Education, 13*(1), 39–42.

CDC. (n.d.). *How COVID-19 spreads.* Centers for Disease Control and Prevention. https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/how-covid-spreads.html

Daymont, T., Blau, G., & Campbell, D. (2011). Deciding between traditional and online formats: Exploring the role of learning advantages, flexibility, and compensatory adaption. *Journal of Behavioral and Applied Management, 12*(2), 156–175.

Efklides, A. (2011). Interactions of metacognition with motivation and affect in self-regulated learning: The MASRL model. *Educational Psychologist, 46*, 6–25.

Fryer, L., & Bovee, H. N. (2016). Supporting students' motivation for e-learning: Teachers matter on and offline. *Internet and Higher Education*, 30, 21–29.

Heyman, E. (2010). Overcoming student retention issues in higher education online programs. *Online Journal of Distance Learning Administration, 13*(4). https://www.westga.edu/~distance/ojdla/winter134/heyman134.html

Ilgaz, H., & Gulbahar, Y. (2017). Why do learners choose online learning: The learners voices. *International Association for Development of the Information Society (IADIS) International Conference on E-Learning*, 130–136. https://files.eric.ed.gov/fulltext/ED579379.pdf

Jaggars, S. S., & Xu, D. (2016). How do online course design features influence student performance. *Computers & Education, 95*, 270–284.

Krupnick, M. (2020, March 26). Online higher education isn't winning over students forced off campus by the coronavirus. *The Hechinger Report*. https://hechingerreport.org/online-higher-education-isnt-winning-over-students-forced-off-campus-by-the-coronavirus/

Lederman, D. (2020, March 18). Will shift to remote teaching be boon or bane for online learning? *Inside Higher Ed*. https://www.insidehighered.com/digital-learning/article/2020/03/18/most-teaching-going-remote-will-help-or-hurt-online-learning

Li, Q., & Akins, M. (2004). Sixteen myths about online teaching and learning in higher education: Don't believe everything you hear. *TechTrends, 49*(4), 51–60.

Mantravadi, S., & Snider, D. (2017). Online teaching overview and misconceptions: Two keys of sustainability in online courses and tools. *Journal of Higher Education Theory and Practice*, *17*(7), 106–110.

Mega, C., Ronconi, L., & DeBeni, R. (2014). What makes a good student? How emotions, self-regulated learning, and motivation contribute to academic achievement. *Journal of Educational Psychology*, *106*(1), 121–131.

Nichols, M. (2010). Student perceptions of support services and the influence of targeted interventions on retention in distance education. *Distance Education, 31*(1), 93–113.

O'Neill, K., & Sai, T. H. (2014). Why not? Examining college students' reasons for avoiding an online course. *Higher Education, 68,* 1–14.

Pastore, R., & Carr-Chellman, A. (2009). Motivations for residential students to participate in online courses. *The Quarterly Review of Distance Education, 10*(3), 263–277.

Sharoff, L. (2019). Creative and innovative online teaching strategies: Facilitation for active participation. *Journal of Educators Online, 16*(2).

Swafford, M. (2018). The relationship between motivation and online self-regulated learning. *Journal of Human Sciences and Extension, 6*(3), 92–106.

Young, S. (2006). Student views of effective online teaching in higher education. *American Journal of Distance Education, 20*(2), 65–77.

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A SYSTEMIC MODEL OF THE LATEST TACTICS IN MARKETING

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ABSTRACT

This qualitative research claims to clarify the respective capabilities, as well as appropriate opportunities brought to digital marketing by social network marketing, big data, inbound marketing, and design thinking. A systemic modeling approach of the general marketing practice describes the relationship and interactions of each of those digital marketing tools. The result is a decision-making conceptual tool designed to help marketers in their practice.

INTRODUCTION

Since it has emerged over sixty years ago, the area of marketing science has grown in importance. It has evolved from a sub-domain of management science to its own autonomous domain with sub-domains, and it became a mandatory part of the study of management.

The more recent rapid acceleration of innovation in online technology changes the nature of the relationship between the consumer and the business environment. It requires marketers to drastically modify their daily practice accordingly.

As explained in this paper, Customer Relationship Management (CRM), for instance was once a one-way flow of data, issued by the organization and delivered to the market. When the organization needed feedback from the market, it used to perform market surveys randomly, with panelists, or using focus groups, gathering knowledge on customers from voluntarily received information.

LITERATURE REVIEW

After the success of the loyalty program created by Steve Humby for Tesco, UK at the beginning of the 21st century (HUM, 2003), the marketing community realized that the information system alone could produce a cheap, fast and accurate set of consumer data related to the customer's buying behavior even if done from outside of the organization. The inconvenience of the three sub-systems model, (Fig.1) the Patrons, the Information System and the Organization, was due to the complexity in managing a loyalty program carrying over the information produced by the Patrons, thereafter transmitted to the organization. This remarkable achievement at Tesco translated into a significant increase of this UK distributor's market share, 30.6% market in 2006 as compared to half of the share a few years earlier.

Currently, "89% of consumers turn to Google, Bing or another search engine to find information on products, services or businesses prior to making purchases". Also, "81% of consumers research online before making big purchases" (Retailing Today, 2013). Moreover, "61% of customers read online reviews before making a purchase decision", (Charlton, 2015) and "67% of consumers are influenced by online reviews" (Hinckley, 2015)" in (PAT, 2016).

The loyalty scheme at that time requested specific competencies from the information system department which was to design and deliver, particularly in analyzing the clusters within the data repository. Highly skilled statisticians segmented the data base of the patrons (the already loyal customers). The homogeneity of the groups was obtained from the customer's life style patterns segmentation which allowed an accurate targeting of these groups of customers.

RESEARCH METHODOLOGY

"Traditional marketing is associated with outbound marketing, which means the marketing strategy pushes the products to the customers, while digital marketing is synonymous with inbound marketing, which mainly aims to win the target interest" (PAT, 2016). Inbound marketing claims to be less invasive because the customer accepts to be identified and targeted, for instance by receiving a newsletter or live webinar invitation. This is a voluntary subscription process with an easy way to opt-out. If the technology makes it fast and convenient, the inbound technique was already used by marketers within a loyalty card program, when customers data were gathered by Tesco (HUM, 2003) in exchange for promotion material linked to their preferences. This customer-focus technique required specific competencies in the marketing department and was difficult to implement. Even if the result was very profitable for the company, retailers actually never made it a general practice, using loyalty cards only as a promotion tool.

Integrating the Latest Tools

The remarkable stability of the MIK model and its update [see Fig.1 in the appendix], first published in 2007 is due to the methodology used in its conceptualization and design.

Findings/Results

The definitions of each domain to which marketing can bring value, e.g. the Environment, once called the market, the Information System, and the Organization have brought a clear and balanced view of the relationship between these three entities.

The new marketing activities that appeared since the rise of the "Web 2.0" as well as the social networks surge can easily fit in the MIK model. The following list of these add-ons became recently popular among marketing scholars and practitioner: Digital Marketing, Inbound Marketing, Design Thinking, Data Analytics, Big Data, Customer Relationship Management, and Customer Knowledge Management. They are described below and positioned within the model.

Examining the above marketing sub-domains and the respective roles they play has led to an update of the MIK model, providing to the marketing community a solid model showing their respective potentials and their strategic utilization. Using the strategic questions (HAM, 2001) Why, What, Where, When, to Whom, and How, help understand the benefits they bring to the marketing activity.

Starting with Digital Marketing and Design Thinking, a definition is given as well as explanations about their respective locations within the model.

DIGITAL MARKETING

Definitions - From e-Marketing to Digital Marketing

Chaffey and Ellis-Chadwick (CHA, 2012) proposed to replace the term e-Marketing with Digital Marketing when they defined Digital Marketing as "reaching out specific marketing goals thanks to the use of digital technology."

This makes this definition a wider scope than the e-marketing, not being inclusive of all the digital tools available, like for instance a tablet used by a sale person or a text message sent by the retailer to the in-store shopping customer, with or without her formal consent. Today, people are exposed to a continuous flow of digital information sent to their smart phones. This makes Digital Marketing a universal set of actions delivered in real time to anyone. The "old dream" of marketers to find the perfect medium for their campaigns became a reality with this change.

Digital Marketing also includes a more robust set of support tools than e-Marketing in such areas as Big Data, Cookies, Customer Relationship Management, Data Mining, Data Warehouse, Database, and Web Transactions Logs. Therefore, Digital Marketing is a wider concept than e-Marketing and it includes all the current digital tools (TIS, 2014)

Practice

Digital Marketing is an important contribution to the firm's competitive advantage, but is not used at the same scale by different size firms. When considering the Business to Customer (B to C) or Business to Business (B to B) relationship, digital tools are less used by small businesses of less than 10 people and 2 million euros of income (NIK, 2017).

The wide definition of Digital Marketing on the other hand does not cover the entire Marketing domain, as Marketing remains the generic name for the domain that includes Digital Marketing, Market Research, Customer Behavior, Strategic Marketing, Marketing Management, International Marketing, Purchasing Marketing, and more specialized marketing such as Insurance Marketing, Real Estate Marketing, etc.

In conclusion, Digital Marketing uses any electronic device and information that can be used in "doing marketing". It should be formally included in the Marketing domain.

INBOUND MARKETING

Definition

A flourishing concept today, inbound marketing, opposes the previous "push" tactic now called outbound marketing. On the model [Fig.1] at the center bottom, is inbound Marketing, adding to the equilibrium of the entire Marketing Domain. The Inbound Marketing looks like the missing piece of a jigsaw puzzle that, once put in place, enlightens the entire picture, revealing this valuable marketing tactic.

Practice

Inbound marketing requires accuracy in targeting an audience and manipulates communication patterns customized for reaching out to this audience. It must deliver valuable content, something the targeted prospect will find useful. In this pull tactic, viewers are asking for content and are motivated to search for information they are interested in. Examples of appropriate pull media are blogs and social networking.

According to Hubspot, (an inbound marketing software platform that helps companies to attract visitors, convert leads, and close customers), Inbound Marketing can be described in four elements (PAT, 2016):

Content Creation and Distribution - create targeted content that answers prospects' and customers' basic questions and needs, then share that content far and wide.

Lifecycle Marketing - clients don't just materialize out of thin air: they start off as strangers, visitors, contacts, and customers. Specific marketing actions and tools help to transform those strangers into patrons.

Personalization - tailor your content to the wants and needs of the people who are viewing it. As you learn more about your leads over time, you can better personalize your messages to their specific needs.

Multi-channel - Inbound marketing is multi-channel by nature because it approaches people where they are, in the channel where they want to interact.

The advantages of Inbound Marketing are: (after PAT, 2016)
- direct, permanent and long-term relationship with the customer
- accurate definition of the "buyer persona" profile
- increase productivity in terms of the benefits / costs compared to the traditional marketing
- development of a content strategy based on specific topics, keywords identified with search engine optimization software like Google Adwords
- creation and distribution of high quality content
- creation of a patron-driven marketing culture within the organization

Design Thinking

A similar approach with Design Thinking is to return a few key words used later in further explanations of the model (see Fig.2 in the appendix): Innovation Process, Business Model, New Project Assessment, Information System, Open source, Networking, Ethno-marketing, Consumer behavior.

Innovation

This practice was recently introduced as the overall goal in Design Thinking (BRO, 2009) and its purpose is to generate innovation, not only new products. Innovation is defined here as an activity that provides a creative synthesis of the most advanced existing knowledge in various domains or that produces a creative activity called break-through innovation. This means it induces a "before and an after innovation" effects.

Some examples of creative synthesis are the tablet computer or the electric car. Those are not new concepts but are products that gather inside a single device the most advanced, already existing technologies, offering to the market a finished product perceived as an innovation. The consequence of this process is a rupture, also called a disruption in the consumption habit. The terms break-through innovation or revolutionary product are often employed. Examples of such innovations are the electric light bulb, the ophthalmology laser, the ballpoint pen or 3D printing. As soon as this type of innovation emerges on the market, its adoption by the customer moves extremely fast. Consumers never go back to the previous product which thereafter is locked in a niche market with people entertaining nostalgia for some "treasures from the past", like writing with a fountain pain in the halo of candle light.

The global competition increases the pressure on firms to release a bigger quantity at a faster pace of innovation in order to create, grow or maintain their competitive advantage in the market place. Some companies, being entirely oriented towards such a goal, have created their own research campus with a curriculum focusing on their industry.

THE THREE PILLARS OF DESIGN THINKING

Design Thinking Theory appears in the model Fig.2 made for practitioners. Some of them have already worked some elements in a Design Thinking approach without calling it by this name. Through the discussion in this paper, the reader should apprehend a strategic vision of the concept. How to apply the model and increase productivity in innovation are questions that this paper tries to answer to.

As shown on Fig.1, Design Thinking activity is managed by the organization. This new approach in marketing management shows a different path to marketers' creativity.
The three pillars of Design Thinking are:
Customer Knowledge Management (CKM)
Business Model
Technology

It is remarkable that the Customer Knowledge Management, barely emerging in marketing when the MIK model (STA, 2009) was first published in 2007, is now a solid building block of Digital Marketing, perfectly hosted within the marketing department. The relatively new approach of Design Thinking is having Customer Knowledge Management, Business Model, and Technology work together as an iterative and collective process. This practice, as depicted in Fig.2 needs strong integration of different competencies inside an organization. The Business Model components need to "work in partnership" with the two others. This dramatically increases the range of competencies of the marketers who sometimes manage an Innovation Department. Their skills in Technology, their knowledge of the market actors, and their ability to conceive a profitable business model tend to change the mindset in the organization, a difficult task for those not having a culture of innovation.

With this evolution, the marketing department gains momentum and should be perceived by the rest of the organization as one of the key players of their corporate strategy. Failing to move in this direction denies the marketing department the ability to launch innovative activities because the final word is given by decision makers who often lack these competencies. They fear making decisions based on what they perceive as a risk, when the Design Thinking process mitigates the risks. The marketing concept of Marketing Myopia illustrates this problem. The Design Thinking model (Fig.2) claims to help CEOs and COOs to understand that the innovation produced by the model cannot fail. The reason for that strong optimism comes from the conceptual approach of Design Thinking.

A project starts with Customer Knowledge Management which, if conducted properly, can assess the market demand in real time. A simultaneous update of the Business Model, which purpose is to prove the outcome profitable, is made by this iterative and collective process as shown on the model. The customer centric marketing is now extended to a broader strategic vision based on profit. After observing the Design Thinking process, not implementing an innovation approach can result in competitors capturing your market share, something no organizations want to happen.

After the marketing goal is set such as creating a new line or a new category of product, the iterations in the process start with Customer Knowledge Management, followed by an update of the Business Model. This update may change the financial structure of the Business Model and the way overheads are distributed or investments are allocated, keeping in realistic sight the break-even point. Due to the iterative process, operations management is also involved in the optimization of the product development. The third element of the Business Model to be adapted is the core

strategy and particularly the tasks of segmenting, targeting, and positioning which are working together with the Customer Knowledge Management. In fact, the data acquired on consumer have a direct impact on the positioning task because knowing your customer will make it easier to make a product that will conquer its target market. The last elements in the Business Model are the resources consisting of assets and people. The Design Thinking model shows that Technology captures a large part of the firm's resources, and the marketing department will look over the team composition, as well as on the budget attributed to the project. In terms of human resources, the collaboration between the technology, and if it exists, the Research & Development department, is mandatory.

DISCUSSIONS AND CONCLUSIONS

The research topic of this paper is inspired by an impression of instability and disturbance found in the Marketing domain. Recently introduced, the networking technologies are a breakthrough innovation in business communication and for consumers to interact with the firm. Scholars and practitioners don't recognize their familiar Marketing landscape anymore. What common sense recommends in such a case of disorientation, is to draw a map that gives a clear vision of the contemporary Marketing "geography".

Whatever the strength of the earthquake, or of the pandemics and the changes induced in the landscape, one should first figure out how to locate on that map what is still left in place. Then the question "Where are we?" can be answered. The outcome of this qualitative research provides to people who are interested in Marketing and Innovation, a representation of this domain and it articulates the tools marketers can use today in the pursuit of their creation then transfer of value to their customers. Starting with the stable MIK model, first published before the social networks, the apps, the big data, the online video, and the design thinking have appeared, this new model clears up the fog and gives marketers a strong and confident feeling that motivates the teams with possibilities never envisioned before.

LIMITATION AND DIRECTION FOR FUTURE RESEARCH

The main limitation on how this model can be experimented comes from the organization's rigidity. Giving to the marketing department a word to say about the business model, as well as an influence on the Research and Development labs, introduces a big change in the firm's management. Companies having a corporate culture of innovation will enthusiastically welcome this model. Others will need to think seriously about reshaping their organization. The model is here to help them and gives a framework for their strategic goals definition. Because not many companies are doing well to integrate these new tools, the new step of this research should measure the respective weights of each tool when used by businesses. This will lead to a quantitative research approach among practitioners.

REFERENCES

Brown T., (2009). *Change by design: How design thinking transforms organizations and inspires innovation*. New York: Harper Collins.

Chaffey & D. Ellis-Chadwick, F., (2012) *Digital marketing: strategy, implementation and practice* (5 ed.). New York: Pearson, p.10.

Hambrick, D. & Fredrickson, J.W., (2005). Are you sure you have a strategy? *Academy of Management Executive, 19*(4), 51-62.

Munroe, J., (2018). The Inbound Methodology - The best way to turn strangers into customers and promoters of your business. *Inbound Software Company.* Retrieved September 29, 2018, from http://www.hubspot.com/inbound-marketing/

Humby, C. & Hunt T., (2003). *Scoring points: How Tesco is winning customer loyalty*. London: Kogan.

Kelley T. & Kelley D., (2013). *Creative confidence: Unleashing the creative potential within us all.* New York: Crown Business.

Nikunen, T., Saarela, M., Oikarinen, E-L., Muhos, M. & Isohella, L., (2017). Micro-enterprises' digital marketing tools for building customer relationships, *Management 12*(2), 171-188.

Patrutiu-Baltes, L., (2016). Inbound Marketing – The most important digital marketing strategy, Bulletin of the Transylvania University of Brasov Series V: Economic Sciences, *9*(58).

Stankosky, M., Green A. & Vandegriff L., (2009). *In search of knowledge management*: *Pursuing primary principles*. Bingley, UK: Emerald Books, pp.163-186.

Teo, T., (2005). Usage and effectiveness of online marketing tools among business-to-consumer (b2c) firms in Singapore, *International Journal of Information Management*, *25*(3), 203–216.

Tissier-Desbordes, E. & Giannelloni, J.-L., (2014). Repenser le marketing à l'ère du numérique, (Marketing Redesign in the Digital Era) *Décisions Marketing*, *73*, 5-8.

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APPENDIX

Fig.1 the 2020 Market Information Knowledge (MIK) Model

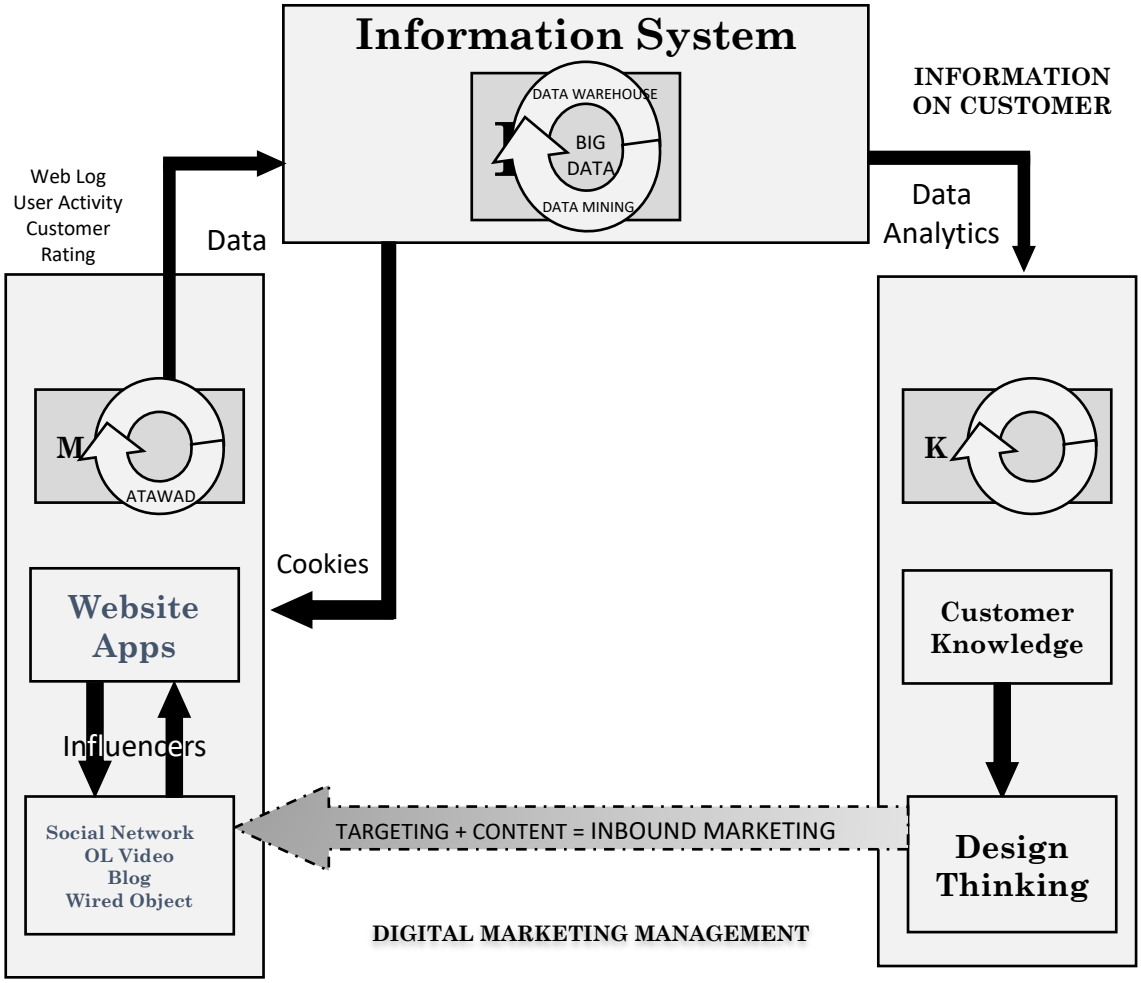
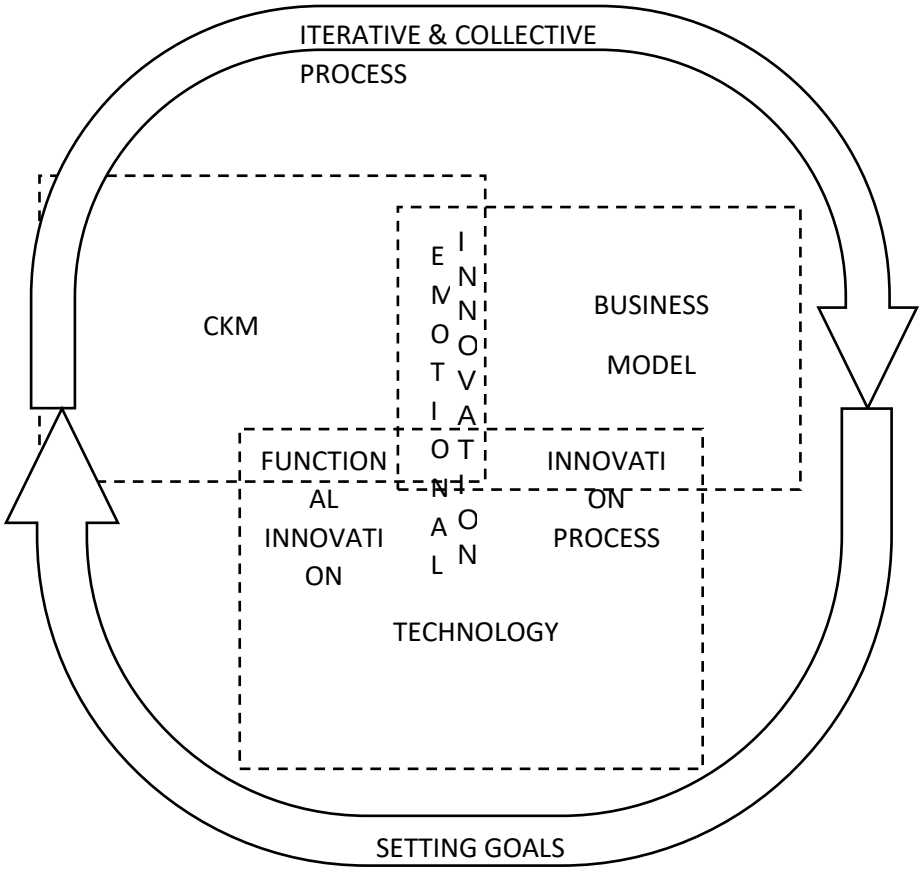


Fig.2 the Design Thinking Conceptual Model



FACTORS THAT CONTRIBUTE TO SOCIAL ENGINEERING:AN INTERDISCIPLINARY PERSPECTIVE FROM INFORMATION TECHNOLOGY, PSYCHOLOGY, AND BUSINESS

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ABSTRACT

Social engineering is the act of using manipulation and deception to obtain access to confidential information. It is considered one of the leading threats to information security today. The topic is complex and increasing in prevalence among individuals and businesses. This paper explores the subject of social engineering from an interdisciplinary perspective. A literature review from the information technology, psychology, and business disciplines explains the interconnected nature of the topic as well as the necessity to comprehend it from multiple viewpoints. An ethical perspective follows the literature review and analyzes social engineering attacks and research from a philosophical and professional viewpoint. An integrated summary promotes the idea of studying the topic from the three disciplines and attempts to explain the complexity of social engineering.

INTRODUCTION

Social engineering can be defined as the act of manipulating human beings, most often with the use of psychological persuasion, to gain access to systems containing data, documents, and information that the social engineer should not have access to obtain (Heartfield & Loukas, 2015; Mitnick & Simon, 2002; Tetri & Vuorinen, 2013). Various forms of social engineering can be found throughout history, but considering the increased use of technology in today's world in every aspect of life, the threat continues to grow and develop into a complex process that can be difficult to stop. In fact, social engineering can be considered one of the leading threats to information security today (Airehrour, Nair, & Madanian, 2018; Mitnick & Simon, 2002).

The interconnectedness of today's world is one of the catalysts for social engineering occurrences. System protections are certainly helpful to mitigate some social engineering attacks, but it is not enough. The Federal Bureau of Investigation's internet crime complaint center cites the increased use of social engineering and business email compromise schemes that have resulted in billions of dollars in losses over the past several years (FBI, 2018). With such a pervasive technique now being used by hackers, it is necessary to use an interdisciplinary approach to understand this phenomenon and all its complexities, especially in the context of how it affects businesses.

INFORMATION TECHNOLOGY DISCIPLINE

The topic of social engineering is important to view from the perspective of information technology. Deceit is certainly used to convince people to share confidential information, but often that deceit involves some sort of software or technical means. System safeguards can help keep confidential information secure, but where they fail, is that they cannot provide protection against the people using the systems (Lineberry, 2007). However, social engineering cannot be discussed unless in the context of the actual information systems and their defenses that are used in the business.

Many of the leading information technology and security journals and publications specifically address the problem of social engineering. Experts in the field have identified the human aspect as the weakest part of the entire information security realm (Aleem, Wakefield, & Button, 2013; Goel, Williams, & Dincelli, 2017; Lineberry, 2007; Mitnick & Simon, 2002). Those tasked with information security almost always have some level of protection for the systems, but organizations today face a converged threat (Aleem et al., 2013) or a hybrid approach (Gold, 2010). This means that the threats come from a variety of sources and have a variety of aims, sometimes on the systems and sometimes on people operating the systems. It is often a combination of both.

Cybersecurity is a term used in the field to refer to protections of systems and data from digital attacks (Aleem et al., 2013; Carlton & Levy, 2017). In terms of cybersecurity, a more specific phrase, *Advanced Persistent Threats (APT)*, explains the complex and multi-faceted approach taken by most hackers to obtain access to systems or information. It is logical to then extrapolate further and conclude that organizations today need safeguards from a systems perspective and a human perspective (Carlton & Levy, 2017; Cotenescu, 2015). There will always be vulnerabilities in terms of both aspects. Systems, specifically entry points to systems, can be vulnerable in addition to the people who are operating them (Alavi, Islam, Mouratidis, & Lee, 2015).

Legacy systems, or systems that are older and often unsupported, can be a significant risk for social engineering attacks (Airehrour et al., 2018). Organizations will continue to use systems and programs that become outdated if they still meet their identified needs because the cost to invest in new systems is often more than an organization's budget will allow. In the meantime, a band-aid approach is used in which minor issues are patched over, and in time, the people operating the systems move on to other roles or other companies (Stern, 2016). Processes that had once been firmly adhered to are no longer part of the standard operating procedures. As a result, legacy systems remain in use, sometimes storing critical pieces of data, and are not properly understood, monitored, or protected from a cyberattack (Stewart & Jurgens, 2017).

Social engineering attacks can exist in a variety of forms ranging from a simple ask to a complex attempt utilizing people and multiple systems. One of the most common methods of social engineering from an information security perspective is phishing scams in which seemingly legitimate emails are sent to individuals with the hope that the recipients click on a link or provide information to the sender of the email (Jansson & von Solms, 2013; Marion, 2018; Moody, Galletta, & Dunn, 2017; Pyzik, 2015). In their study, Goel et al. (2017) contextualized email messages to determine if they can be crafted in such a way that more people are susceptible to them. Capitalizing on some psychological factor, such as fear of losing or the hope of gaining something, helps attackers successfully use a mode of communication, such as email, to get access to a system or data. The researchers found that when people received an email offering them the possibility of free items such as an iPad or a gift card, they were more susceptible to the social engineering attack. This study supports the connection between information technology and the psychology discipline.

Jansson and von Solms (2013) simulated multiple types of phishing attacks, changing the subject of their emails to determine how they can exploit human weak points. For example, one of their phishing attempts was a legitimate-looking email that notified the recipient that a database had crashed and as a result, the username or password to log in to a system must be provided to restore access. Besides mirroring an authentic email that appeared like it came from within the organization, the phishing attempt had a sense of urgency, hoping the user would react quickly and provide the requested information.

Technical defenses can be used as a form of risk mitigation and usually a multitude of control strategies is recommended to be used (Budzak, 2016). Multifactor authentication is a common and often effective way for organizations to ensure that the person accessing the systems should have that access (Airehrour et al., 2018). For example, a login process with a username and password would be one way for the user to be authenticated. An additional factor could be the use of a virtual private network (VPN) login to further validate the user.

Information security professionals are concerned with how employees might view and interpret social engineering attempts differently. Phishing attempts discussed previously can be positively or negatively framed and people have various ways of deciphering messages contained in those emails. Interestingly, information security professionals lean on psychological and demographic aspects to identify susceptibility to phishing attacks (Goel et al., 2017; Sheng, Holbrook, Kumaraguru, Cranor, & Downs, 2010). In one study, more women opened a phishing email, but there was little to no variation in the number of women that clicked on the enclosed links compared to the number of men that clicked on the links (Goel et al., 2017). Another study proposed that men understand technology more than women, so they were less likely to fall victim to a social engineering attempt in which confidential information was requested (Sheng, et al., 2010). However, other researchers determined that more men than women were likely to become victims of social engineering (Happ, Melzer, & Steffgen, 2016). One study determined that those in the age range of 28 – 38 were less likely to provide their own personal information (Airehrour et al., 2018) while another study determined that younger people were more likely to reveal a password when asked (Happ et al., 2016) and were more susceptible to phishing attacks (Sheng, et al., 2010). The contradictory findings in the previous studies could be examined further to determine whether the form of the study or the participants involved led to the respective outcomes.

These types of studies have major implications for the information technology field and could determine how social engineering training might be tailored to different genders. The subject also raises ethical implications when discussions focus on varying genders or ages. Information technology professionals must use caution when applying these findings to organizations to minimize stereotyping based on gender or age and to ensure employers do not discriminate and use demographics when hiring for open positions.

A one-size fits all approach from a security perspective might not be the most appropriate answer (Goyette, Robichaud, & Marinier, 2013). The solutions to converged threats should be viewed in terms of converged solutions. It can be difficult to structure the information technology department to implement this converged approach, and often, an organization does not have enough experts in both the physical security side of systems and social engineering understanding to deal with the multitude of threats (Aleem et al., 2013).

PSYCHOLOGY DISCIPLINE

Social engineering is all about deception; therefore, a psychological approach to understanding the concept is of the utmost importance to grasp the underlying thoughts and behaviors of both the attacker and victim. The use of psychological methods is important to social engineering because they are used to bypass the protections that may be in place such as firewalls and systems used to identify intruders (Bullee, Montoya, Pieters, Junger, & Hartel, 2018). Essentially, the entire information technology network at a particular company is only as strong as the individual user of a particular system. In fact, the behavior and actions of employees are one of the leading causes of data breaches (Abawajy, 2014).

Several researchers have found ways to understand and explain social engineering using psychological theories. After all, it is people who work in organizations, interact with each other, and access the systems that are trying to be protected. One of the key elements used in social engineering is persuasion, and several researchers have used key characteristics of persuasion (Cialdini, 2007) that are essential to an attack (Bullee, Montoya, Pieters, Junger, & Hartel, 2015; Bullee et al., 2018; Komatsu, Takagi, & Takemura, 2013; Muscanell, Guadagno, & Murphy, 2014). They include reciprocation, commitment, social proof, liking, authority, and scarcity (Cialdini, 2007). The various influences are based on qualities found in the victim but are used on behalf of the attacker to exploit a psychological trait leading to the desired access.

Persuasion is an inherent quality of social engineering and focuses specifically on the connection between the attacker and the victim. For example, how likely is it that employees obey authority figures in their organization? Bullee et al. (2015) proposed that the use of authority would increase the likelihood that a social engineering attack would succeed. While the assumption was logical, they could not validate this hypothesis, but they attributed it to cultural differences in the power of authority.

Bullee et al. (2018) conducted a study to determine whether various forms of information awareness (e.g., pamphlet, key chain, or poster) used as an intervention would mitigate the effect of authority in a planned social engineering attack. Employees not subjected to the intervention were almost three times more likely to provide the social engineer posing as a facilities manager with keys to their offices. However, the intervention did not significantly change the effect that authority had on the employees. They attributed the cultural explanation described earlier as one of the reasons why the intervention had little to no effect on the power of authority.

An alternative example using conformity looked at how closely employees mirrored their behaviors to others in the organization (Meng & Jun, 2017). Another study using reciprocity analyzed how indebted people felt to do something for someone else in return for a gesture that was done for them (Happ et al., 2016). The principle of likability was studied solely in the context of an online setting, and it was determined that it is not a significant influencer in that type of environment (Guadagno, Muscanell, Rice, & Roberts, 2013). Recognizing the principles of persuasion as well as understanding how likely an employee is to fall for one of the principles, helps the social engineer plan and implement a successful attack.

When using persuasion, Tetri and Vuorinen (2013) have identified characteristics that are present in the potential victim in a persuasive situation such as laziness, greed, and trust. For example, if a social engineer identifies an employee as having a high level of trust, the attacker may feel that there is a better chance that rapport can be built with the employee which then has a higher likelihood of leading to a successful attack.

Other studies have discovered certain consistent, identifiable qualities that might make employees more susceptible to becoming victims. Social engineers will prey on these “social entry points” (Tetri & Vuroinen, 2013) and exploit human qualities such as the fear of losing / eagerness to gain (Cheung-Blunden, Cropper, Panis, & Davis, 2018; Goel et al., 2017;), likability and trust (Flores, Holm, Svensson, & Ericsson, 2013; Guadagno et al., 2013), boredom

proneness (Moody et al., 2017), or positive characteristics such as patience and kindness in addition to negative characteristics such as greed or hubris (Fan, Lwakatare, & Rong, 2017).

Interventions using psychological behavioral theories can be used on behalf of organizations to decrease susceptibility to social engineering attacks. Companies may ask themselves how they can alter an employees' thoughts and eventual actions to ensure they are not tricked into divulging data to parties that should not have access to that information. Such theories have been identified by social engineering researchers including protection motivation theory which explains how people protect themselves from perceived threats and social learning theory which explains the importance of observational learning and modeling of behavior (Bullee et al., 2015). Some components of social learning theory can align with the concept of conformity as mentioned in the discussion on the principles of persuasion. Individuals are social beings and therefore, tend to match their behaviors with those around them especially in a work setting (Meng & Jun, 2017).

Normative social influence, or the desire to be liked and recognized by others, has been identified as a factor in social engineering attacks (Khooshabeh & Lucas, 2018). If an attacker can identify a person with a penchant for gaining approval from others (perhaps relaying the message that the employee, by providing that information, would be helping the requestor immensely), that employee may be more likely to share data. By complying with the request for information, the employee's desire to be liked by someone outweighs adhering to the protocols that one knows should be followed.

In their research, Tetri and Vuorinen (2013) have discussed the importance of not only the context of social engineering situations but how people will interpret the situations in which they find themselves. Perception can be different based on the person, the organizational culture, and the nature of the business itself. Individuals are said to interpret their surroundings through frames that are built upon their knowledge and experiences regarding a certain situation. Two people can see the same event taking place and interpret everything about the event differently based on their own inherent biases, knowledge, and role in the organization. The idea of perception poses a challenge to researchers or professionals in practice who are trying to better understand the factors that lead to social engineering attacks.

Emotions can be a powerful influencer in changing a person's thoughts and attitudes. In fact, the use of emotions is already widely used in politics and advertising so it makes sense that it would also be used in an organizational context (Van Kleef, van den Berg, & Heerdink, 2014). Emotions and their impact on other employees relate to the previous discussion on the principles of persuasion. Depending on emotional states, employees might respond to one of the persuasion techniques when experiencing one emotion compared to when experiencing another (Van Kleef et al., 2014).

While it has been identified that emotions are common in organizational settings, a further distinction can be made as to whether emotions are used by males or females. Indeed, people's perceptions of which gender displays emotion impact the interpretation of that emotion (Salerno & Peter-Hagene, 2015). Researchers found that opinions expressed by emotional women do not influence as many people as the opinions expressed by emotional men. This fact can relate to social engineers and victims as there can now be a gender component used to determine how one can be more persuasive. The study also concluded that when men express anger, they are viewed as more powerful and persuasive, and in fact, even more credible than if the emotion was not present. Perhaps a male social engineer, showing anger in an appropriate situation, can convince an unsuspecting employee to provide confidential information. However, anger expressed on behalf of women was not as influential as when males used it. In the study, Salerno and Peter-Hagene (2015) found that people who viewed a woman expressing anger believed the woman to be more emotional and not at all persuasive in changing the views of others.

Cybersecurity has previously been discussed from the perspective of information technology. The field itself is growing at a fast pace and particular emphasis has been placed on the concept of psychology as it pertains to protecting systems and data. Dawson and Thompson (2018) have identified the interdisciplinary nature of the field. They have discovered that cybersecurity professionals have vast and specialized knowledge in their own discipline but are lacking in their understanding of the broader social aspects that have a significant impact on data protection. Understanding personal and social characteristics has been largely overlooked in the past, but many industries are seeing the importance of this knowledge as they build their information technology departments (Vogel, 2016). Never before has

there been such a strong emphasis placed on the psychological aspect of information technology and how companies use their knowledge of human behavior to mitigate social engineering attacks (Dawson & Thomson, 2018).

BUSINESS DISCPLINE

Social engineering can impact several types of businesses and have implications for the way that organizations are structured and managed. The topic can be viewed from the business perspective to determine what the factors are that impact social engineering attacks. This viewpoint is beneficial if it is considered in more specific terms related to the following areas of business: training and development, documented policies, internal audit procedures, budgets, and organizational culture. A deficiency in any of these areas can contribute to attacks.

The business literature identifies many psychological and information security aspects of social engineering, but when it comes to implementing protections, it tends to fall on managers of the various departments in the organization. It is not only an issue affecting the information technology department, but rather all professional departments such as finance, marketing, sales, operations, and human resources, and all support departments such as the administrative staff, maintenance, and facilities. No one in an organization is immune to social engineering attacks; therefore, a comprehensive approach that affects all of the organization should be implemented by management to protect the company (Jackson, 2018; Pyzik, 2015).

Training on the various types of social engineering attacks can be one of the best preventative measures to ensure that employees do not fall victim to these attempts in addition to spreading the word and being open about potential phishing scams that may be circulating through an organization (Jansson & von Solms, 2013; Moody et al., 2017). Training usually falls under the umbrella of the human resources department or at each managerial level and should be an integral part of the overall training and development program of the company.

Systems theory has been used in multiple disciplines and explains how the various systems found in diverse environments interact with and impact each other (Adams, Hester, & Bradley, 2013). It can be used from a business perspective to better understand the groups and subsystems that comprise an organization, both formally and informally, and identify where there are gaps in the security framework (Ritzman & Kahle-Piasecki, 2016; Young & Leveson, 2014). After all, organizations consist of complex relationships and alliances, and it is critical for managers to understand how these networks impact information security (Nekoranec, 2013). The literature from a business perspective integrates psychological themes since the very nature of analyzing employee behavior draws on many theories from that discipline. Essentially, managers are using a multi-dimensional approach to protect themselves from social engineering attacks by analyzing employee behavior and merging those ideas with their business training to mitigate a risk to information security (Drew & Cross, 2013).

Internal audit procedures should be performed in addition to training to ensure that each organization understands how the various techniques could be applied in their unique environments. One of the most effective internal audit procedures is social engineering testing. Various forms of testing include drafting internal phishing emails to analyze employees' reactions to the message or putting employees in various situations in which they are unaware that someone is trying to deceive them into providing information (Pyzik, 2015). However, even though the idea of internal audits is widely accepted among organizations today, many companies do not have the proper resources to effectively perform them (McCollum, 2016).

Awareness on behalf of employees is one of the best ways to mitigate a social engineering attack (Pyzik, 2015). The audit procedures and training should be an integrated effort among various departments and be designed with flexibility and adaptability in mind (Jackson, 2018). The reason for this is that the information security landscape changes constantly. As soon as employees are trained in a particular area, the attackers are quick to realize that their efforts might be ineffective, and therefore, modify their attempts to implement a new, unsuspecting attack. The behaviors and motivations that exist on behalf of the social engineer are varied and complex making it even more challenging since there is not a specific profile that an attacker fits (Marion, 2018).

Most managers today are trained in many areas of business such as creating budgets, staffing, and meeting production quotas, but few are actually trained in understanding and analyzing employee behavior and consequently using this as a tool to help predict behavior (Nekoranec, 2013). To encourage particular behaviors, managers should have a clearly defined policy on what is considered acceptable and unacceptable behavior. Additionally, the repercussions for

violating a policy should be clear as well as a process for those found in violation (Ritzman & Kahle-Piasecki, 2016). Policies can also dictate how employees should handle a suspected social engineering attempt, to whom it should be reported, and the proper procedure to document the attack (Marion, 2018).

The absence of training programs or lack of knowledge about the subject can be factors that contribute to successful attacks. However, social engineering protection must be viewed in terms of a cost-benefit analysis and risk assessment (Olifer, Goranin, Kaceniauskas, & Cenys, 2017) since businesses operate with financial budgets and figures as the guiding source for almost all decisions made within a company. Organizations are sometimes quick to implement innovative technologies without allocating the proper resources toward protections of the new technologies. The driving force behind these decisions is to move ahead of competitors, gain market share, or capitalize on a need in an industry. If the proper security measures are not in place, it can lead to a social engineering attack (Harkins, 2016). On the other hand, if the cost to protect a certain tool or technology is significantly more than the monetary value of the benefits received from that protection, then the cost might not be worth it (Olifer et al., 2017).

Organizational culture is the final business focus that should be considered when discussing factors that can impact a social engineering attack. A culture that does not have a strong focus on information security makes the organization more susceptible to social engineering occurrences (Budzak, 2016). "Culture is the strongest form of control" and establishes the tone that can be observed in every level of the organization (Harkins, 2016, p.8). As previously mentioned, it is widely understood that social engineering protection is the responsibility of every department and every level of a business (Budzak, 2016). A culture with an emphasis on information security incorporates and links it to every facet of the organization (Ritzman & Kahle-Piasecki, 2016). Employees often identify with the values promulgated throughout the organization. If one of the values is information security, then employees will feel a sense of commitment to align themselves with this core value (Buschgens, Bausch, & Balkin, 2013).

Organizational culture can be reflected in many ways in a company. Workspace layouts in organizations should be conducive to both privacy as well as appropriate information sharing. It truly is a balance to manage both concepts from seemingly opposite ends of the spectrum (Goyette et al., 2013). Workspaces should be designed to encourage trust among employees while also increasing productivity (Congdon & Gall, 2013). Culture can be reflected in the communication between employees and the different hierarchical levels in the organization. It also includes how open and honest employees are encouraged to be regarding possible attacks or their suspicions as well as how receptive management is to their concerns.

ETHICAL IMPLICATIONS

Ethics is important when dealing with the topic of social engineering and can be viewed from the perspective of a legitimate attack and from the viewpoint of testing in which fabricated attempts are used for learning and training purposes. The two views can be examined from philosophical theories and the professional code of ethics from the Society for Human Resource Management (SHRM).

The very idea of manipulating another human being violates many ethical principles. In the aftermath of a social engineering occurrence, treatment of the victims can vary, but often, they are poorly treated and blamed for allowing the hack to occur. It is ironic to note that the qualities usually found in ideal employees such as trust; the willingness to please others such as managers, customers, co-workers and visitors; and the readiness to obey authority are usually the same characteristics that make an individual susceptible to social engineering (Mouton, Malan, Kimppa, & Venter, 2015).

In addition, one of the most successful protections against social engineering attacks is the use of susceptibility testing in which fabricated attempts to obtain access to systems are implemented on unsuspecting employees. Many organizations are using these tests to train employees and improve behavior (Jansson & von Solms, 2013; Pyzik, 2015). The purpose of the attacks is to identify weak areas in terms of the person, the department, or the company as a whole, and correct those weak areas to create stronger, less susceptible qualities that social engineers prey on to gain access. However, employees who do fall victim to one of the testing attacks might develop feelings of uneasiness, uncertainty, and mistrust of managers. If the feelings are prevalent throughout the organization, employee morale could be negatively affected, causing a host of other problems besides social engineering susceptibility (Jackson, 2018). Companies will have to ask themselves, to what extent do we want to guard against attacks if it comes at the expense of our employees' well-being?

Mouton et al. (2015) analyzed various components and questions of social engineering according to three different ethical perspectives including virtue ethics, utilitarianism, and deontology. The question of whether it is ethical to conduct social engineering research can be answered from the three different viewpoints. From the perspective of virtue ethics, performing this type of research is ethical only if the researcher does not inflict harm on any of the participants and that the researcher debriefs the participants after the study is complete. From the perspective of utilitarianism, research on the subject is ethical if it contributes to the advancement of society. From the perspective of deontology, social engineering research is unethical since part of the process involves lying and deceiving the participants (Mouton et al. 2015).

The SHRM code of ethics encourages people to ask various questions to determine whether the action is considered ethical. Some of the questions include: Will this build trust and credibility for the company? and Will it help create a working environment in which the company can succeed over the long term? (SHRM Code of Ethics, 2014). This particular code of ethics has a significant emphasis on the individual person and the respect and dignity associated with people's actions towards each other. A legitimate social engineering attack is a clear violation of this code of ethics since it disrespects anyone who falls victim to the attack. Research and susceptibility testing can be viewed as ethical, according to the code of ethics, as long as people are treated with respect, no harm or negative consequences result, and that the purpose of the testing is to positively impact company success.

There are additional ethical considerations regarding the fact that it is an obligation of companies to protect the confidential data they possess (Anderson, Bakerville, & Kaul, 2017). For example, when someone shares a social security number with a financial services company or receives a medical diagnosis from a physician, it is assumed that discretion will be used on behalf of employees who have access to that information. People expect that the company will protect that information from being shared with outside parties. Therefore, the companies have an ethical, and sometimes legal, responsibility to protect themselves from intrusions to systems or engage in various social engineering safeguards.

INTEGRATED SUMMARY

The prior literature review from the three distinct disciplines explains the need for an integrated approach to examine the complex subject of social engineering. Each discipline, on its own, provides information on how to understand and interpret the topic, protect against various types of attacks, and understand the impact of social engineering from both a human and organizational standpoint. However, each discipline's interpretation of the topic is only useful when viewed in the context of the other two disciplines.

The literature from the perspectives of information technology, psychology, and business explains that an integrated approach must be used by organizations who want to defend themselves against this growing threat. The danger of social engineering is that it is a converged threat (Aleem et al., 2013) which makes it more difficult to find solutions. There is no simple, straight-forward, cookie-cutter approach to dealing with this problem (Jouini, Rabai, & Khedri, 2015). Focusing solely on the individual aspect (psychology) can only go so far in protecting an organization if the systems and company culture are ignored. Concentrating only on the systems (information technology) does not place enough emphasis on the people operating them and completely ignores the power of the collective employee base. Attention only placed on internal audit procedures and financial budgets (business) disregards the need to understand basic human tendencies and the importance of system checkpoints to ensure the confidentiality of information. Contributing to the complexity is the fact that all organizations are faced with the threat of social engineering regardless of industry, location, company size, and years in existence.

As a further illustration, one can look at the suggestions outlined in the psychology and information technology perspectives to mitigate social engineering attacks. If more attention is devoted to understanding employee behavior (psychology) and newer and better systems are suggested to be used (information technology), then both of the recommendations depend primarily on the financial ability of the firm to offer such protections and the willingness of the established company culture to incorporate strategies for social engineering protections (business).

CONCLUSION

Social engineering has been identified as the most significant threat in the information security field today (Airehrour et al., 2018; Mitnick & Simon, 2002). One of the most alarming aspects of social engineering is that no one is immune from its effects. A company is only as strong as the most vulnerable individual employed there, and with some businesses containing thousands of employees, the threat is daunting and very real. Social engineering is best understood from an interdisciplinary perspective, specifically the information technology, psychology, and business disciplines. This integrated approach helps to address the idea of a converged threat that is a major concern for businesses today (Aleem et al., 2013). The ethical implications have also been explored, and it can be helpful to view the topic as well as research on the subject from different ethical perspectives stemming from philosophical or industry practices. The increased use of technology and the increased interdependence that is seen in the business world today support the idea that social engineering will continue to be a threat for organizations of all types.

REFERENCES

Abawajy, J. (2014). User preference of cyber security awareness delivery methods. *Behaviour & Information Technology, 33*(3), 236 – 247. Retrieved from Social Sciences Citation Index.

Adams, K., Hester, P., & Bradley, J. (2013). A historical perspective of systems theory. *Proceedings of the 2013 Industrial Systems Engineering Research Conference*. Retrieved from https://www.researchgate.net/publication/288782223_A_historical_perspective_of_ systems_theory

Airehrour, D., Nair, N., & Madanian, S. (2018). Social engineering attacks and countermeasures in the New Zealand banking system: Advancing a user-reflective mitigation model. *Information, 9*(5), 10. doi: 10.3390/info9050110

Alavi, R., Islam, S., Mouratidis, H., & Lee, S. (2015). Managing social engineering attacks: Considering human factors and security investment. *Proceedings of the Ninth International Symposium on Human Aspects of Information Security and Assurance.*

Aleem, A., Wakefield, A., & Button, M. (2013). Addressing the weakest link: Implementing converged security. *Security Journal*, 26(3), 236-248. doi: 10.1057/sj.2013.14

Anderson, C., Baskerville, R., & Kaul, M. (2017). Information security control theory: Achieving a sustainable reconciliation between sharing and protecting the privacy of information. *Journal of Management Information Systems, 34*(4), 1082 – 1112. doi: https://doi.org/10.1080/07421222.2017.1394063

Budzak, D. (2016). Information security: The people issue. *Business Information Review*, *33*(2), 85-89. doi: 10.1177/0266382116650792

Bullee, J., Montoya, L., Pieters, W., Junger, M., & Hartel, P. (2018). On the anatomy of social engineering attacks: A literature-based dissection of successful attacks. *Journal of Investigative Psychology and Offender Profiling, 15*(1), 20 – 45. Retrieved from Social Sciences Citation Index.

Bullee, J., Montoya, L., Pieters, W., Junger, M., & Hartel, P. (2015). The persuasion and security awareness experiment: Reducing the success of social engineering attacks. *Journal of Experimental Criminology*, *11* (97), 115. doi: 10.1007/s11292-014-9222-7

Buschgens, T., Bausch, A., & Balkin, D. (2013). Organizational culture and innovation: A meta-analytic review. *Journal of Product Innovation Management, 30*(4), 763-781. doi:10.1111/jpim.12021

Carlton, M. & Levy, Y. (2017). Cybersecurity skills: Foundation theory and the cornerstone of advanced persistent threats (APTs) mitigation. *Online Journal of Applied Knowledge Management, 5*(2), 16-28. Retrieved from Complementary Index Database.

Cheung-Blunden, V., Cropper, K., Panis, A., & Davis, K. (2018). Functional divergence of two threat-induced emotions: Fear-based versus anxiety-based cybersecurity preferences. *Emotion.* https://doi.org/10.1037/ emo0000508

Cialdini, R. (2007). *Influence: The Psychology of Persuasion*. New York, NY. Harper Collins.

Congdon, C., & Gall, C. (2013). How culture shapes the office. *Harvard Business Review, 91*(5), 34-35. Retrieved from *Social Sciences Citation Index*.

Cotenescu, V. (2016). People, process, and technology: A blend to increase an organization security posture. *Scientific Bulletin, 16*(2). doi: 10.21279/1454-864X-16-I2-057

Dawson, J., & Thomson, R. (2018). The future cybersecurity workforce: Going beyond technical skills for successful cyber performance. *Frontiers in Psychology, 9*(744). doi: 10.3389/fpsyg.2018.00744

Drew, J., & Cross, C. (2013). Fraud and its prey: Conceptualizing social engineering tactics and its impact on financial literacy outcomes. *Journal of Financial Services Marketing. 18*(3),188-198. doi:10.1057/fsm.2013.14

Federal Bureau of Investigation (FBI), (2018). *Internet crime complaint center*. Retrieved from https:/www.ic3.gov Fan, W., Lwakatare, K., Rong, R. (2017). Social engineering: I-E based model of human weakness for attack and defense investigations. *Computer Network and Information Security,1*, 1-11. doi: 10.5815/ijcnis.2017.01.01

Flores, W., Holm, H., Svensson, G., & Ericsson, G. (2013). Using phishing experiments and scenario-based surveys to understand security behavior. *Information Management and Computer Security, 22*(4), 393-406. doi: 10.1108/IMCS-11-2013-0083

Goel, S., Williams, K., & Dincelli, E. (2017). Got phished? Internet security and human vulnerability. *Journal of the Association for Information Systems, 18*(1), 22-44. Retrieved from Academic Search Premier.

Gold, S. (2010). Social engineering today: Psychology, strategies, and tricks. *Network Security, 2010*(11), 11-14. doi: 10.1016/S1353-4858(10)70135-5

Goyette, R., Robichaud, Y., & Marinier, F. (2013). A research agenda for security engineering. *Technology Innovation Management Review*, 41 – 50. https://doaj.org/article/8bafe65d71ed49ef95afe1b809fb932a

Guadagno, R., Muscanell, N., Rice, L., & Roberts, N. (2013). Social influence online: The impact of social validation and likability on compliance. *Psychology of Popular Media Culture, 2*(1), 51 -60. doi: 10.1037/a0030592

Happ, C., Melzer, A., & Steffgen, G. (2016). Trick with treat – Reciprocity increases the willingness to communicate personal data. *Computers in Human Behavior, 61*, 372 – 377. http://dx.doi.org/10/1016/j.chb.2016.03.026

Harkins, M. (2016). The cause is also the cure. *People & Strategy, 39*(1), 7 – 8. Retrieved from Business Source Premier.

Heartfield, R., & Loukas, G. (2015). A taxonomy of attacks and a survey of defense mechanisms for semantic social engineering attacks. *ACM Computing Surveys, 48*(3), doi: 10.1145/2835375

Jackson, R. (2018). Pulling strings. *Internal Auditor, 75*(4), 34 – 39. Retrieved from Business Source Premier.

Jansson, K., & von Solms, R. (2013). Phishing for phishing awareness. *Behavior & Information Technology, 32*(6), 584-593. doi: 10.1080/0144929X.2011.632650

Jouini, M., Rabai, L., & Khedri, R. (2015). A multidimensional approach towards a quantitative assessment of security threats. *The 6th International Conference on Ambient Systems, Networks, and Technologies, 52*(2015). doi: 10.1016/j.procs.2015.05.024

Khooshabeh, P., & Lucas, G. (2018). Virtual human role players for studying social factors in organizational decision making. *Frontiers in Psychology, 9*(194). doi: 10.3389/fpsyg.20180194

Komatsu, A., Takagi, D., & Takemura, T. (2013). Human aspects of information security: An empirical study of intentional versus actual behavior. *Information Management & Computer Security, 21*(1), 5-15. doi: 10.1108/09685221311314383

Lineberry, S. (2007). The human element: The weakest link in information security. *Journal of Accountancy*. Retrieved from https://www.journalofaccountancy.com/issues/2007/nov/thehumanelementtheweakestlinkininformationsecurity.html

Marion, M. (2018). Socializing with a social engineer. *Rural Telecom, 37*(4), 32-3. Retrieved from Business Source Premier.

McCollum, T. (2016). Time to shift the mind-set. *Internal Auditor,73*(2), 11-3. Retrieved from Business Source Premier.

Meng, R., & Jun, Y. (2017). 360 degrees of social influence: How others' presence, attitudes, and behaviors change the way we think and behave. *Advances in Consumer Research, 45*, 181 – 185. Retrieved from Business Source Premier.

Mitnick, K., & Simon, W. (2003). *The art of deception*. Indianapolis, IN. Wiley.

Moody, G., Galletta, D., & Dunn, B. (2017). Which phish get caught? An exploratory study of individuals' susceptibility to phishing. *European Journal of Information Systems, 26*, (6), 564 – 584. https://doi.org/10.1057/s41303-017-0058-x

Mouton, F., Malan, M., Kimppa, K., & Venter, H. (2015). Necessity for ethics in social engineering research. *Computers & Security, 55*, 114 – 127. https://doi.org/10.1016/j.cose.2015.09.001

Muscanell, N., Guadagno, R., & Murphy, S. (2014). Weapons of influence misused: A social influence analysis of why people fall prey to internet scams. *Social and Personality Psychology Compass, 8*(7), 388-396. https://doi.org/10.1111/spc3.12115

Nekoranec, J. (2013). Management and organizational behavior: Some basic aspects. *Journal of Defense Resources Management, 4*(1), 93 – 98. Retrieved from Directory of Open Access Journals.

Olifer, D., Goranin, N., Kaceniauskas, A., & Cenys, A. (2017). Controls-based approach for evaluation of information security standards implementation costs. *Technological and Economic Development of Economy, 23*(1), 196 – 219. doi:10.3846/20294913.2017.1280558

Pyzik, K. (2015). Shutting the door on social engineering. *Internal Auditor, 72*(5), 20 – 21. Retrieved from Business Source Premier.

Ritzman, M., & Kahle-Piasecki, L. (2016). What works: A systems approach to employee performance in strengthening information security. *Performance Improvement, 55*(8), 17 –22. doi: 10.1002/pfi.21614

Salerno, J., & Peter-Hagene, L. (2015). One angry woman: Anger expression increases influence for men, but decreases influence for women, during group deliberation. *Law and Human Behavior, 39*(6), 581 – 592. doi:10.1037/lhb0000147

Sheng, S., Holbrook, M., Kumaraguru, P., Cranor, L., & Downs, J. (2010). Who falls for phish? A demographic analysis of phishing susceptibility and effectiveness of interventions. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems.

Society for Human Resource Management (SHRM): Code of Ethics (2014). Retrieved from https://shrm.org/about-shrm/Pages/code-of-ethics.aspx

Stern, A. (2016). SOCs require more than a band-aid approach. *Information-management.com*. Retrieved from Business Source Premier.

Stewart, H., & Jurjens, J. (2017). Information security management and the human aspects in organizations. *Information & Computer Security, 25*(5), 494 – 534. Doi: 10.1108/ICS-07- 2016-0054

Tetri, P., & Vuorinen, J. (2013). Dissecting social engineering. *Behavior & Information Technology, 32*(10). doi: 10.1080/0144929X.2013.763860

Van Kleef, G., van den Berg, H., & Heerdink, M. (2015). The persuasive power of emotions: Effects of emotional expressions on attitude formation and change. *American Psychological Association, 100*(4), 1124 – 1142. http://dx.doi.org/10.1037/apl0000003

Vogel, R. (2016). Closing the cybersecurity skills gap. *Salus Journal, 4*(2), 32 – 46. Retrieved from Directory of Open Access Journals.

Young, W., & Leveson, N. (2014). Inside risks: An integrated approach to safety and security based on systems theory. *Communications of the ACM, 57*(2). doi: 10.1145/2556938

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THE STATE OF AUGMENTED REALITY, VIRTUAL REALITY, AND MIXED REALITY

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ABSTRACT

Through the use of handheld devices, such as tablets and smartphones, augmented reality applications have helped change the business landscape. Augmented reality applications blend real and digital assets to improve the user's experience. On the other hand, virtual reality applications create alternative realities where users are fully immersed in the experience. Virtual reality applications accomplish this through the use of specialized gear such as headsets and handheld controllers. However, many businesses do not understand what these terms mean, let alone how these technologies can be utilized in their business. It is the goal of this exploratory study to provide practical definitions for each of these technologies thereby reducing a barrier to entry.

INTRODUCTION

This paper represents a preliminary report of an ongoing study examining augmented, virtual, mixed, and extended reality from a business perspective. These fields are relatively young, having spanned only the last couple of decades. Research has identified a number of barriers to the adoption of the various XR technologies including user acceptance, hardware limitations, software limitations, and cost (Laurell et al., 2019; Massod & Egger, 2020; Stolz et al., 2017). While some businesses have successfully utilized these technologies, for many companies it remains unclear how they can leverage any of these technologies, or even what any of these 'realities' even mean. It is the intent of this portion of the larger study to provide practical definitions for each technology.

AUGMENTED REALITY

In 1968, Ivan Sutherland introduced the first head-mounted device (HMD), which presented the wearer with a three-dimensional image that changed perspective based upon the user's orientation. This invention ushered in the new arena of augmented reality (AR). Augmented reality is generally defined as a real-time enhanced interactive experience created by overlaying data and objects in the real world (Bronack, 2011; Klopfer & Squire, 2008). However, as early as 1901, the concept of enhancing the physical word through special glasses had been introduced by writer L. Frank Baum (Johnson, 2012).

Early visions of augmented reality focused on the technology required to merge the real physical world with the virtual one. These definitions contained the restriction that AR includes the use of HMD (Milgram et al., 1994). Representing the available hardware at the time, this narrow definition of AR certainly limited its applications. However, modern technology has allowed applications of AR to expanded well beyond this definition. Today, tablet computing devices, such as the iPad and HDFire, have extended the utility of AR (Martin et al., 2011). The capabilities of these tablets have also significantly enhanced the interactive experience. Features such as single touch, multi-touch gestures, and global positioning systems (GPS) have dramatically altered the AR user experience. The further adaptation of AR onto mobile devices such as smartphones has made it possible to use AR applications almost anytime and anywhere they travel (Broll et al., 2008).

As almost anyone who has stood in a furniture showroom can attest, trying to imagine what a piece of furniture will look like in one's home can be a daunting task. One advantage enjoyed by traditional brick and mortar retail stores over online retailers is that customers could at least see and touch the items before purchase. Yet, there can be an immense disappointment when the reality of the selected article does not match our mental image. In recent years, several retailers have introduced AR applications that overly catalog items into real world spaces (see Figure 1). An examination of the Google Play Store and Apple App Store indicates that more than a dozen similar applications currently exist. The providers of these applications are primarily online-only vendors and also mostly startups. Comparable applications can be found in many other retail spaces such as interior design, paint and wall coverings, clothing, eyewear, and landscaping, to name a few.

Figure 1

Examples of Augmented Reality Retail Applications

Note: The image on the left uses a smartphone to overlay a sofa in its intended location (top3 AR, n.d.). The image on the right uses a tablet to alter a wall color to the selected paint color (ViewAR, 2012).

While AR has been very successful in many business uses, it is not without challenges. One of the AR uses often discussed is the ability to overlay data, such as Yelp reviews, in real-time when traveling on foot or by car (see Figure 2). As demonstrated by the image on the right, applications overlaying real-time data tend to be successful when the world space is small, and the amount of data being processed is well-known and small. Foremost among the challenges with the image on the left is the amount of data that has to be queried, processed, and displayed in an outdoor, real-time setting (van Krevelen & Poelman, 2010).

Figure 2

Real-time Data Augmented Reality Examples

Note: The image on the left integrates customer review data in real-time as the user changes locations (Rossi, 2017). The image on the right demonstrates real-time farming data on a tablet (Ekkasit919, n.d.).

VIRTUAL REALITY

Virtual reality (VR) is defined as an immersive, computer-generated three-dimensional environment that simulates one or more of the five senses (Burdea & Coiffet, 2003). VR differs from AR in that AR is a composite world of real and computer elements; whereas, VR creates an immersive alternative world. Another key difference between AR and VR is that VR requires the use of a helmet or visor and handheld motion controllers or wands (see Figure 3). These helmets can be uncomfortable for long-term use. In addition, VR has been found to induce health conditions

such as heart rate variability and motion sickness (Ohyma et al., 2007). Also, the gear required for VR results in a higher barrier to entry for VR.

Figure 3

Virtual Reality Example

Note: The image shows a researcher wearing a typical virtual reality helmet and handheld motions controllers. The computer screen depicts what the wearer sees in the virtual world (Melis, 2020).

While there have been a significant number of business AR applications, most VR applications are games. These games are mainly persistent alternative realities that never close where players can visit and interact as personalized avatars (Penfold, 2009). One area outside of games that have seen success in the VR application space is tourism. These applications allow users to investigate and even interact with displays inside museums, tourist or historical sites, or even visit different historical times (Hsu, 2012; Huang et al., 2016).

MIXED REALITY

As the lines between AR and VR features blur, a new definition is needed. Speicher et al. (2019) sought experts' advice to precisely classify mixed reality (MR). They concluded that while it is essential to share a common vocabulary, the experts surveyed agree that the classifications change over time. One of the six distinct definitions of MR that resulted is that MR is simply a combination of AR and VR.

Throughout the MR literature, the common idea is that MR allows for the interaction between the real world and computer-generated assets. For example, the future kitchen area will display computer-generated assets in multiple locations (see Figure 4). The computer-generated assets such as recipes, to-do list, sports, and weather would be familiar in many AR applications. Likewise, the headgear shown would be similar to that in many VR applications. However, it is the unique interaction between objects that demonstrate MR potential. A recipe asset would interact with the real world pantry and fridge to show recipes containing items currently on hand. Likewise, a To-Do asset would interact with a planner or scheduling software.

Thus, MR is a merger of the real and digital world where things coexist, interact, and respond to the user and each other in real-time (Milgram et al., 1995).

Figure 4

Mixed Reality Example

Note: The image shows the possibilities of a future mixed reality kitchen (NBC News, 2015)

EXTENDED REALITY

Extended reality (XR) is an umbrella term comprising all of augmented reality, virtual reality, and mixed reality. As such, it renders moot the multiple definitions of Speicher et al. (2019) for MR. It also means that there is no longer a need to debate exactly where a particular implementation belongs on the continuum developed by Milgram et al. (1994). Finally, it frees the consumer from trying the understand the nuances between these constructs. It will be interesting to see the level to which this singular definition will be adopted over the previous ones.

METHODOLOGY

In the second part of this research project, custom software will be written to query the application programming interface (API) of the most common application stores, Google, Apple, and Steam, to ascertain the number and classification of publicly available XR applications. Additionally, the companies supplying the applications will be classified to determine if XR is primarily the domain of startups or if companies listed in the primary U.S. stock exchanges are actively engaged in XR application development for the public. Initial attempts to gather this information using online sites that query the respective database were not successful due to corrupted datasets. Thus, interfacing with the data directly should prove more fruitful.

It is understood that this will only give a partial understanding of the XR application landscape as there is no way to discover the number of private (internal) XR applications in use or under development.

REFERENCES

Broll, W., Lindt, I., Herbst, I., Ohlenburg, J., Braun, A. K., & Wetzel, R. (2008). Toward next-gen mobile AR games. *Computer Graphics and Applications*, IEEE, *28*(4), 40-48. doi: 10.1109/MCG.2008.85

Bronack, S. C. (2011). The role of immersive media in online education. *Journal of Continuing Higher Education 59*(2), 113-117. doi: 10.1080/07377363.2011.583186

Burdea, G. C., & Coiffet, P. (2003). *Virtual reality technology* (Vol. 1): Hoboken, NJ: John Wiley & Sons.

Carrino, F., Rizzotti, D., Gheorghe, C., Kabasu Bakajika, P., Francescotti-Paquier, F., & Mugellini, E. 2014. Augmented reality treatment for phantom limb pain. In Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics). V. 8526 LNCS. Springer, Cham. 248–257. doi: 10.1007/978-3-319-07464-1_23.

Ekkasit919 (n.d.). Dreamstime. https://www.dreamstime.com/iot-smart-farming-agriculture-industry-technology-concept-farmer-hold-tablet-to-use-augmented-mixed-virtual-reality-soft-iot-image128388982

Hsu, L. (2012). Web 3D simulation-based application in tourism education: A case study with second life. *Journal of Hospitality, Leisure, Sport & Tourism Education, 11*(2), 113-124. doi: 10.1016/j.jhlste.2012.02.013.

Huang, Y.-C., Backman, K. F., Backman, S. J., & Chang, L. L. (2016). Exploring the implications of virtual reality technology in tourism marketing: An integrated research framework. *International Journal of Tourism Research, 18*(2), 116-128. doi: 10.1002/jtr.2038.

Johnson, J. (2012). The master key: L. Frank Beam envisions augmented reality glasses in 1901. Mote & Beam, 10. http://moteandbeam.net/the-master-key-l-frank-baum-envisions-ar-glasses-in-1901

Klopfer, E., & Squire, K. (2008). Environmental detectives: The development of an augmented reality platform for environmental simulations. *Educational Technology Research and Development, 56*(2), 203-228. doi: 10.1007/s11423-007-9037-6

Laurell, C., Sandström, C., Berthold, A., & Larsson, D. (2019). Exploring barriers to adoption of virtual reality through social media analytics and machine learning–an assessment of technology, network, price and trialability. *Journal of Business Research, 100*, 469-474

Ohyama, S., Nishiike, S., Watanabe, H., Matsuoka, H., Akizuki, H., Takeda N., & Harada T. (2007), Autonomic responses during motion sickness induced by virtual reality. *Auris Nasus Larynx, 34*(3), 303-306. doi: 10.1016/j.anl.2007.01.002.

Martin, S., Diaz, G., Sancristobal, E., Gil, R., Castro, M., & Peire, J. (2011). New technology trends in education: Seven years of forecasts and convergence. *Computers & Education, 57*(3), 1893-1906. doi: 10.1016/j.compedu.2011.04.003

Melis, P. (2020). The SURF explore project on use of XR for research and education. SURF Communities. https://communities.surf.nl/en/article/the-surf-explore-project-on-use-of-xr-for-research-and-education

Milgram, P., Takemura, H., Utsumi, A., & Kishino, F. (1994). Augmented reality: A class of displays on the reality-virtuality continuum. Proceedings the SPIE: Telemanipulator and Telepresence Technologies, 2351, 282-292.

Masood, T., & Egger, J. (2019). Augmented reality in support of industry 4.0—implementation challenges and success factors. *Robot: Computer-Integrated Manufacturing. 58*, 181–195.

NBC News (2015). Microsoft's hololens headset augments your reality with windows. https://www.nbcnews.com/tech/gadgets/microsofts-hololens-headset-augments-your-reality-windows-n290756

Penfold, P. (2009). Learning through the world of second life—a hospitality and tourism experience. *Journal of Teaching in Travel & Tourism*, *8*(2-3), 139-160. doi: 10.1080/15313220802634224.

Rossi, B. (2017). How augmented reality is transforming e-commerce. *Information Age.* https://www.information-age.com/augmented-reality-transforming-e-commerce-123465096/

Stoltz, M., Giannikas, V., McFarlane, D., Strachan, J., Um, J., & Srinivasan, R. (2017). augmented reality in warehouse operations: Opportunities and barriers. *IFAC-PapersOnLine*, *50*(1), 12979-12984. doi: 10.1016/j.ifacol.2017.08.1807.

Sutherland, I. (1968) A head-mounted three dimensional display. AFIPS '68, fall, part I: Proceedings of the December 9-11, 1968, fall joint computer conference, part I, 757-764. doi: 10.1145/1476589.1476686

top3 AR (n.d.) App Store Preview. https://apps.apple.com/au/app/top3-ar-augmented-reality-3d/id1294223930

van Krevelen, D.W.F, & Poelman, R. (2010). A survey of augmented reality technologies, applications and limitations. *International Journal of Virtual Reality*, *9*(2), 1-20 .

ViewAR (2012). ViewAR augmented reality painting demo. *YouTube.com.* https://www.youtube.com/watch?app=desktop&v=FifMRnnmyNE

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PATERSON'S OPTION TO INCUBATE: BUSINESS INCUBATING ANALYSIS AND ECONOMIC STABILITY

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ABSTRACT

Despite being the third most populous city in New Jersey, Paterson with nearly 30% of residents' income below the poverty level, Paterson needs immediate economic growth and renewal. This becomes more essential with current covid-19 situation. Strategies need to be discussed about how to better help business owners survive.

Business incubators provide services such as shared office-space, business training/mentoring assistance, links to capital, IP and social networks. We are trying to explore factors that will help to contribute to success of local business community.

To conduct this study all business data of Paterson from 2015-2018 was collected and reviewed focusing on the SIC data sourced from Info USA. It should be noted, Paterson is unique with numerous zip codes areas, lack of business resources/education due to small size needs to be improved in the future.

The Paterson, NJ economic data analyzed, found several factors contributing to the local business success, (e.g., credit score and white-collar percentage contributed positively to the success of business sales volume.)

Our analysis suggests, local government need to implement business incubator (BI) according to the feature of each zip code. We suggest different types of BI for individual zip codes, setting up smaller sized incubators will help Paterson local business owners with better training in capital investment, technology skills development, legal education and others. Lastly, BI will help the local community grow in a mutual business environment with an anticipated higher success rate.

Note: Steven DiGirolamo, an undergraduate student at William Paterson University, was a significant contributor to this paper.

INTRODUCTION

Paterson needs immediate economic growth and renewal. Despite being the third most populous city in New Jersey, Paterson's median household income is approximately $36,000, well below the state of New Jersey average with nearly 30% of residents' income below the poverty level. Long term economic sustainability is critical to increasing the welfare of Paterson residents. Based on discussions from Propel Paterson, one proposed strategy is "Paterson should leverage the resources of its partners including local universities, the NJEDA, SBDC and others as well as seek out new sources of financial and human capital to develop a competitive, modern workforce. This may include the development of a business incubator and the solicitation of funds through grants. Local universities could help further this cause by increasing their support for civic engagement amongst students."

A business incubator serves an interface between a business idea and the real market. Business incubators provide services such as shared office-space, business training/mentoring assistance, links to capital, IP and social networks. Business incubators have been widely adopted and supported as a tool for economic growth. Previous research results have demonstrated that business incubation is especially important to fostering young entrepreneurship through the most vulnerable start-up phase (Aernoudt, 2004 and Chandra et al. 2007).

There has been a growing interest in business incubation and the impact it can have on societies. There has been a significant body of research developed on the topic of business incubation in past years (Hackett and Dilts, 2004b). The concept of business incubation refers to a systematic effort to propel new firms in the early stage of their activity in a controlled environment. This is done through a combination of infrastructure, development-support processes and expertise needed to spurt incubatees growth (Tötterman and Sten, 2005). Shared office-space, mentoring and business training, access to social networks are all tools for economic growth for a business, which results in growth for the economy. Previous research shows that in the most valuable start-up phase, business incubation is extremely important

(Chandra et al. 2007). Most businesses fail during the earliest stage of development. (Dunne, Roberts, & Samuelson, 1988).

The importance of incubators for the regional and national economy has also been proven illustrated in scholarly articles (Tsai et al. 2009). However, there seems to be very little research on the services or value-added features which may be tailored to local communities especially minority communities. In short, incubators should be modified for local demand and in-line with local economic developing strategy.

This research project is be focused on Paterson, New Jersey and options to incubate based on three revenue models and to explore the best combination. We will explore and identify current business incubators in the Paterson area, analyze factors contributing to the success of the incubator and develop economic cost and benefit consideration.

LITERATURE REVIEW

There have been many success stories on business incubators and their impact to grow small businesses. Joey Crooker, the founder of Home-Aid, used a business incubator to help start his business. Joey stated without the incubator he wouldn't have made it, wanting to nearly quit four or five times (Pearson, 2005). Norma Johnson used a nonprofit incubator, an affiliate of South DeKalb Business Association to help redo her business plan and to figure out her financing. This incubator is also home to 25 other small businesses and is a great success (Dozier, 2003). EpigenDX, a startup biotech company went through a business incubator provided by Massachusetts Biomedical Initiatives (MBI). MBI provided all the equipment and facilities need so a company could grow and focus on the science and not majorly the business. Li Ying Yan, said that the access they were given was a major help, because they didn't have to buy all the expensive equipment necessary to start. This MBI incubator success rate is 75 percent, significantly higher than the industry average of 56 percent (Meindersma, 2012).

Not every company that goes through a business incubator will be successful. Out of the 74 companies that went through the South Side Pittsburgh business incubator, 15 have failed or 20%. The resulting 80% is a much higher success rate than the normal startups of organizations (Olson, 2014).

Research has already been done on the importance of business incubators and the success they have. With local universities near Paterson, we can relate this topic to the research and importance of University based business incubators. There have been lots of research on university business incubators already. This incubator is a UBI, defined as a university-based institution. This relates in the sense that Paterson may be able to use local universities as incubators. UBI provides support for young businesses through tangible and intangible services in order to support growth of its tenants. They also rely on funding from public and private sources (Dahms & Kingkaew, 2016). University based incubators can help lower the cost because the necessary location and space is usually there. Also, business schools will be great at leading young entrepreneurs because they have the business and management knowledge already (Dahms & Kingkaew, 2016). Having the experience and necessary tools to lead start-ups is extremely beneficial.

Looking more into depth on specific university business incubators, The University of Central Florida (UCF) has developed a technology incubator that is university-driven, providing early stage technology companies with the tools they need. Their goal is to create a high-tech industry. As of December 2004, the UCF incubator has assisted more than 70 firms and was named 2004 Incubator of the Year. More than 600 jobs have been created in the Central Florida community, and clients have generated more than $140 million in revenue (O'Neal, 2005). This is just a specific example of a business incubator, but there was research done on more than just this specific university. Six university technology business incubators were examined and their impact on the development of technology-based firms. The study concludes that university images, laboratories and equipment, and student employees, added major value to the client firms (Mian, 1996). Studies have shown that university-based incubators are proven to help grow and guide small start-up business.

There is research on the effects of business incubators internationally. There were studies done if incubators really do improve the performance of start-ups. This specific research was from Korea. The results from this research were that mentoring, and investor-linking activities of an accelerator do have a positive effect on attracting follow-up investment. Results also positively affected the employment increase of the business (Koo, 2018). Another study was done with Business Incubators in China. A major finding was the number of graduates from an incubator is closely

associated with the human resources, infrastructure, and financial resources of the incubator (Zhang & Sonobe, 2010). Business Incubators have a clear impact of building foundation in start-ups.

The research shows that business incubators are successful in leading start-ups toward success; however, there seems as if there is little research on the services or value-added features which may be tailored to local communities, especially minority communities. Our goal is to explore and identify demands for business incubators in the Paterson area including tangible and intangible service and analyze the factors contributing to the success of business incubators and develop economic cost and benefit consideration from a real options' viewpoint.

URBAN TRANSFORMATION

The goal of funding and transformation of cities is to make them become self-sufficient and less dependent on the state. Over recent years, New Jersey has been providing cities with large amounts of money, yet no strategy to create a self-sufficient city and economy. Instead of just giving billions of dollars, more focus should be made on making sure the dollars go towards a coherent strategy. Clear focus should be made on the long term, the goal is for a sustainable future. Also, realization in the importance of building partnerships. Cities need to reach out to everyone they can to help grow the city. There are many different partnerships that can be made that can contribute to the growth of the city. Motivated people that want to make an impact are necessary to succeed (Mallach and Sterner, 2008)

Economic and Workforce Development are essential when it comes to offering great opportunities for residents. There must be a restructure in educational and workforce development systems to prepare residents for jobs with a living wage and promotion opportunities. Residents benefiting from job and business growth will help the economy grow by sending in great workers into the job system ((Mallach and Sterner, 2008).

Cities must also redevelop the neighborhood and residencies. Safe streets with well-maintained houses and apartments occupied by different income levels and ethnicities. Great schools are required that offer opportunities for kids.

DOWNTOWN REVITALIZATION

A healthy downtown often can correlate with a healthy community. The heart of the city, where most of the population is held and the noise is made. Downtown revitalization is often a top priority in rebuilding a city. Creating a positive image and attitude toward the downtown can go a long way. Two indicators to consider providing a sense of effectiveness of downtown revitalization efforts are:

1. Occupancy rates
2. Diversity of Uses

The National Trust for Historic Preservation realize that the difference is extremely noticeable in property values, upper floor occupancy, numbers of restaurants and numbers of housing units. Over this time, there will be a decrease in personal service businesses on the street level moving them to secondary locations such as side streets or upper floors. The main streets will be used for retail uses (Mullin and Kotval, 2003). Having entertainment venues and restaurants at the downtown, linked by public transportation would create a gathering place for the community. Making downtowns into a 24/7 mixed-income community is essential for city growth (Mallach and Sterner, 2008).

CURRENT STATUS OF BUSINESS INCUBATORS

In the cities of New Jersey there are lots of different business incubators. They provide different services such as space, training/mentoring, access to IP, capital/ fund raising and networking. In 1953, the U.S. Small Business Association (SBA) was created to help aid these small businesses to increase growth. The SBA also funds **Small Business Development Centers (SBDC)** throughout the entire United States. These development centers offer free and low-cost training to individuals looking to start small businesses. The SBDC also has university partnerships throughout the entire country, with multiple in New Jersey.

University programs have many different specializations to spurt the growth and lead new small businesses. A basic list of what is offered are listed below:

- Competitions
- Student funding
- Training
- Mentoring
- Networking
- Space
- Guest Speaker Services
- Mobile Application Development
- Loans
- Research

Universities and their small business development centers make a great impact because of the resources they have to offer. This is just one small portion of what type of incubators there are.

The New Jersey Business Incubation Network (NJBIN), is a statewide partnership between business experts, local organizations, and NJ universities ("Incubator Report", 2016). They provide basic incubator services such as:

- Space (labs, offices, computers, conference rooms)
- Academic and Professional services
- Networking

SPECIFIC NJ UNIVERSITY INCUBATORS

A number of different University Incubators exist in New Jersey. Audiences range from students, faculty and staff, community, and business owners. For Paterson, New Jersey, the focus should be on community and business owner incubators rather than students and faculty.

The NJIT Enterprise Development Center creates an environment for companies with less than 4 years of experience to have space to do work. They will even invest in the company if they meet a certain criterion. The College of New Jersey has small business development centers for Mercer County, New Jersey also.

Rutgers University has networking events that can raise the profile of social entrepreneurship, social innovation, and social business in New Jersey by hosting events that bring entrepreneurs together. Rutgers also has a Food Innovation Center, which is unique for food business incubation and their economic development.

New Jersey City University has a Business Development Incubator that has office space and development programs in all business fields ("Incubator Report", 2016)

These are just a few examples of New Jersey University's providing incubators for communities. These incubators are essential in business growth and success rate.

PATERSON WEAKNESS

The city of Paterson, New Jersey has a number of items that need to be improved to attract private investment. The local William Paterson University and Montclair State University are both institutions that have strengths that could help the growth of Paterson.

The education level in Paterson is below average compared to the rest of Passaic County. 10.8% have achieved a bachelor degree compared to 28.1% of the rest. This results in a less highly educated and skilled workers in their economy to create economic development.

Table 1: Paterson vs Passaic County Residents Education Level

Education	*Paterson*	*Passaic County*
High School Graduate	73.4%	83.4%
Bachelor's Degree or Higher	10.8%	28.1%

NOTE: Percent of persons age 25 years+
Source: U.S. Census

Much of infrastructure is old and outdated. There are a lot of outdated buildings with no tenants leaving large spaces unused. With the improvement of this space, the property value will increase and the quality of the city. These empty buildings can be used for businesses or hold tenants to raise income for the city.

Table 2: Housing Unit Comparison

Housing Units	*Paterson*	*Passaic County*
Owner-occupied housing unit rate	26.3%	53.0%
Median value of units	$ 237,500.00	$ 336,600.00

Source: U.S. Census

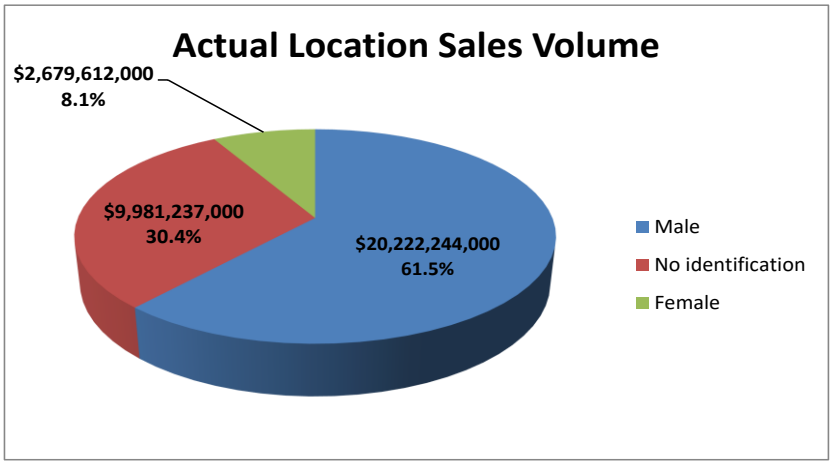
DATA

To conduct this study all business data of Paterson, New Jersey from 2015-2018 was collected from Info USA. SIC data was reviewed and was used to analyze business economic data in Paterson. The SIC data will provide the strength and weaknesses of Paterson, New Jersey based off different business fields.

The dataset covers 16 zip codes in the Paterson area. The data includes the name, year established, credit score, sales volume, white collar percentage, zip code, male/female owner, SIC code and if it is a small business.

A basic generalization of the data was first taken to find general info. Our dataset shows 8.1% business owners are female, 61.5% male and 30.4% had no identification. With nearly a third of the business owners having no identification, using gender as an independent variable is not recommended due to the large amount of missing data.

Table 3: Actual location Sales Vol by male/female



1,207 Selected SIC codes were analyzed. In the dataset, 1,133 out of 1,209, or 93.7%, have an actual location sales volume. and 64.6% of actual location sales volume were generated from four zip codes. The top 5 and bottom 5 SIC codes based off sales volume were organized to show strength and weakness in Paterson and also separated based off

zip code. The top 5 include Petroleum, Industrial Machinery and Equipment, Office and Clinics of Doctor's of Medicine, Food Preparations, Medical and Hospital Equipment. The bottom 5 are Shoe Repair, News Dealers and Newsstands, Laundry and Garment Services, Dance Studios, Schools and Halls and Photocopying and Duplicating Services.

Table 4: Top 5 SIC codes contributing to the Actual Location Sales Volume

Selected SIC Code	Selected SIC Description	Actual Location Sales Volume	% to total	Cum Total
5172	Petroleum	$1,904,384,000	5.8%	5.8%
5084	Industrial Machinery and Equipment	$978,805,000	3.0%	8.8%
8011	Office and Clinics of Doctor's of Medicine	$946,094,000	2.9%	11.6%
2099	Food Preparations	$823,378,000	2.5%	14.1%
5047	Medical and Hospital Equipment	$754,714,000	2.3%	16.4%

Table 5: Bottom 5 SIC codes contributing to the Actual Location Sales Volume

Selected SIC Code	Selected SIC Description	Actual Location Sales Volume
7251	Shoe Repair	$328,000
5994	News Dealers and Newsstands	$151,000
7219	Laundry and Garment Services	$125,000
7911	Dance Studios, Schools and Halls	$108,000
7334	Photocopying and Duplicating Services	$90,000

Sic code 5172, Oils and Fuels is at the top with 35% of the Actual Location sales. All of the other SIC codes are roughly the same percentage. This provides a good visual of how the top businesses in respect to actual location sales volume is diversified.

Table 6: Top 5 SIC Actual Location Sales in millions, pie chart

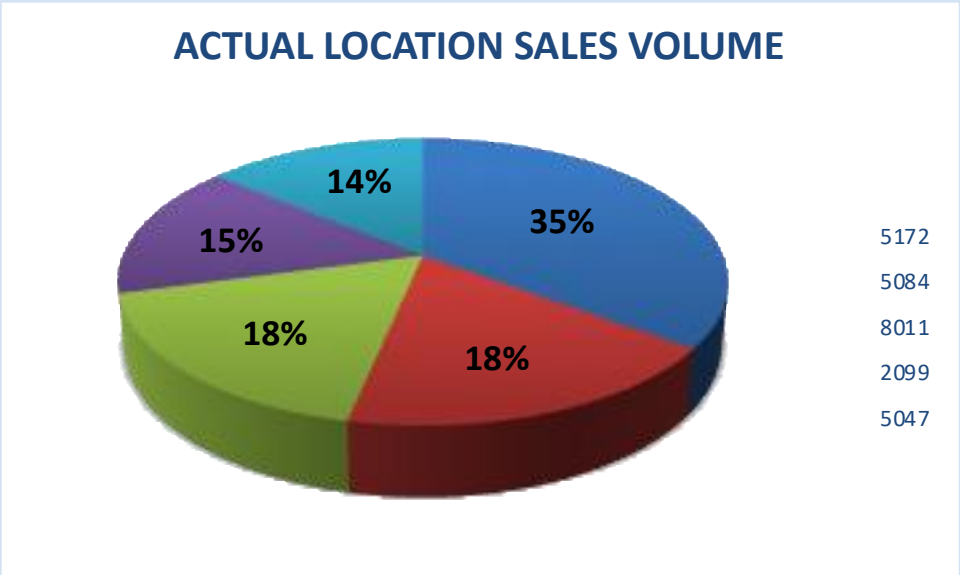
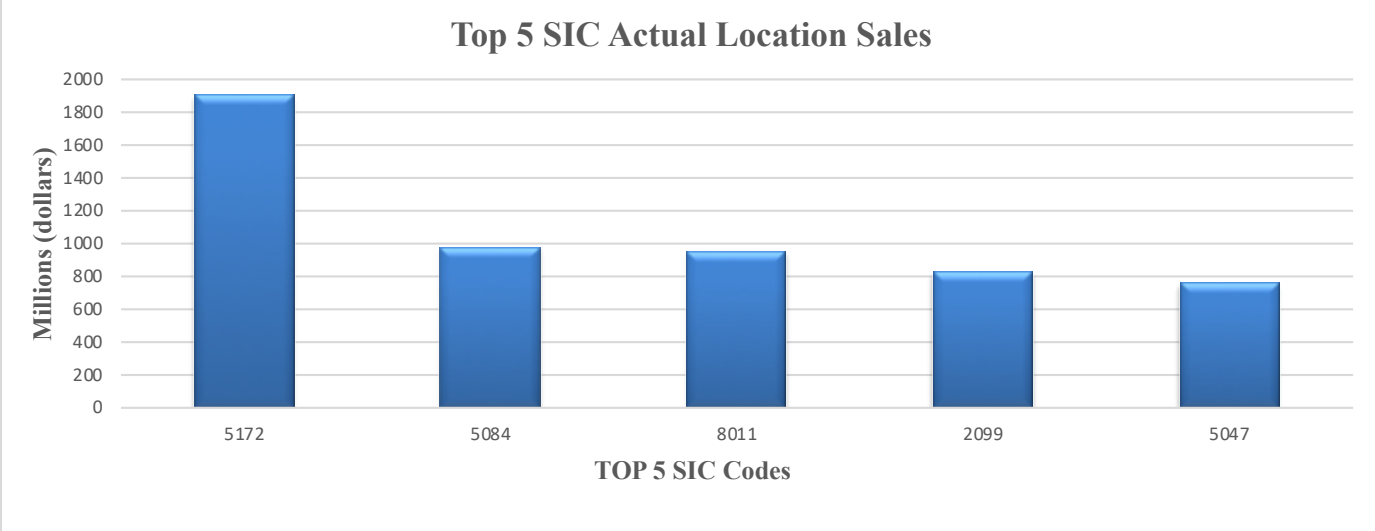


Table 7: Top 5 SIC Actual Location Sales in million, bar chart



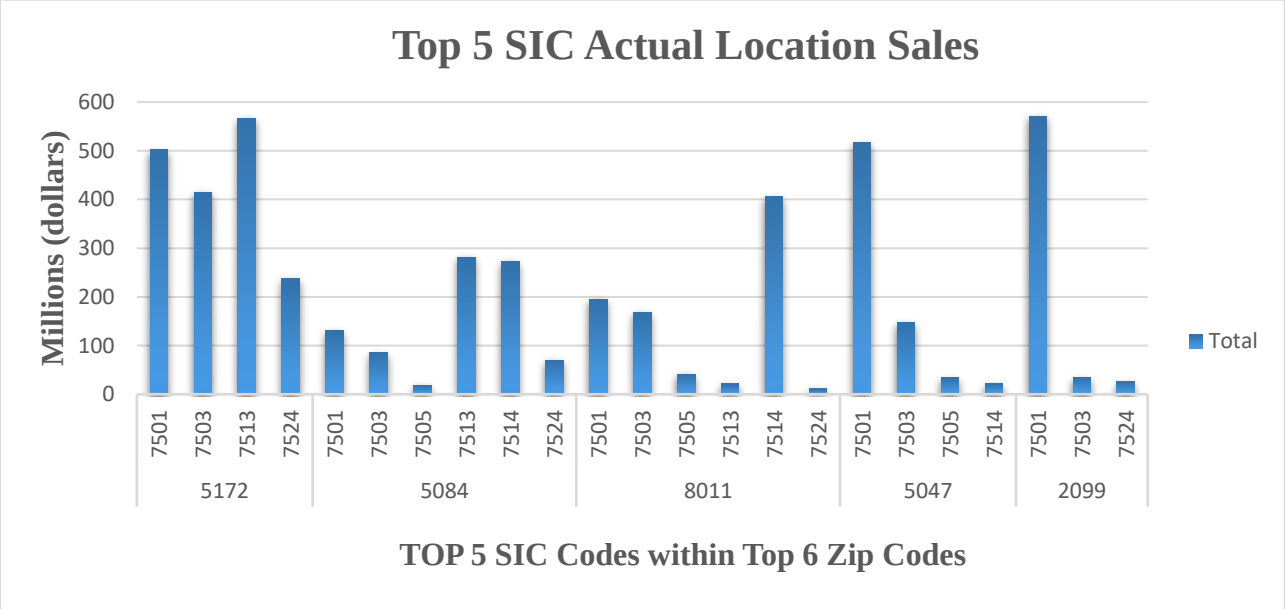
All the business data was separated by zip code and ranked from highest to lowest actual location sales volume by dollars. Six zip codes contributed to approximately 80% of the actual location sales volume. This means this is where most of the business is taking place. Since the business is taking place here, it makes sense to put the most emphasis on growing these areas.

Table 8: Six zip codes contribute approximately 80% of the Actual Location Sales Volume

Primary Zip Code	Actual Location Sales Volume	% to total	Cum Total
7501	$7,050,832,000	21.4%	21.4%
7503	$6,784,901,000	20.6%	42.1%
7514	$4,007,446,000	12.2%	54.3%
7524	$3,390,022,000	10.3%	64.6%
7513	$3,222,436,000	9.8%	74.4%
7505	$2,329,537,000	7.1%	81.5%
7502	$1,850,039,000	5.6%	87.1%
7509	$1,760,574,000	5.4%	92.4%
7504	$1,308,462,000	4.0%	96.4%
7522	$998,026,000	3.0%	99.5%
7543	$59,175,000	0.2%	99.6%
7533	$52,971,000	0.2%	99.8%
7544	$49,877,000	0.2%	99.9%
7512	$18,539,000	0.1%	100.0%
7538	$256,000	0.0%	100.0%
7508	$0	0.0%	100.0%
(blank)	$0	0.0%	100.0%
Grand Total	**$32,883,093,000**	**100.0%**	

To break down the SIC codes in respect to which zip code they are located in, a visual was provided to show where most of their sales are taking place. The dominance of certain zip codes is clear in the table.

Table 9: Top 5 SIC Codes with Top 6 Zip codes



For this research, only the top 5 SIC Codes (not the bottom) will be analyzed. It doesn't make sense to focus on an industry with only 1 or 2 businesses. The growth should be focused on the markets that have the most opportunity.

ANALYSIS RESULTS

We have analyzed our dataset using regression with the dependent variable log sales. A summary table is first provided. Next, we ran the regression using the total dataset with independent variables being zip code, years appeared in yellow pages, credit scores of business, white collar percentage and if it is a small business centered. This is shown in Table 11.

Table 10: Summary table, 15,012 Observations

Category	Mean	Median	Standard Deviation	Minimum	Maximum	Count
ACTUAL LOCATION SALES VOLUME	-0.591059711	-0.794073099	1.374011856	4.268697949	6.440946541	15012
YEAR FIRST APPEARED IN YELLOW PAGES	13.26192379	10	9.505872353	1	35	15012
CREDIT SCORE	0.820643485	0.82	0.079270029	0.55	1	15012
WHITE COLLAR PERCENTAGE	0.525483613	0.56	0.319979701	0	0.99	15012
SMALL BUSINESS	0.350119904	0	0.477023181	0	1	15012

Table 11: Dependent Var: log sales vol

	Coefficients	*Standard Error*	*t Stat*
Intercept	-7.47228	0.123303	-60.601
ZIPCODE	-0.00847	0.003438	-2.46498
YEAR FIRST APPEARED IN YELLOW PAGES	-0.01116	0.001345	-8.29714
CREDIT SCORE	8.2053	0.1584	51.80127
WHITE COLLAR PERCENTAGE	0.841238	0.030086	27.96108
SMALL BUSINESS	-0.31931	0.021918	-14.5683
OBS	15,012		

Independent Variables

- **Zip code**
  We have found the zip code matters for the success of business. Different zip code areas seem to have various impact on the success rate of business. Because of this, we ran a regression analysis based on subsamples of the top 6 zip code areas.

- **Year first appeared in Yellow Pages**
  How many years a business has been operating may have a mixed impact. By a business operating longer, it proves that they have been successful enough to continue. People may go to the old restaurants that have been around increasing their success rate. However, newer businesses may be more intact with technology and new age marketing such as social media. Old businesses may not have adapted to newer markets.

- **Credit Score**
  The credit score of business is an important factor too because it will affect their loan rate. A higher credit score obviously meaning a better loan rate than someone with a lower credit score. Loan impacts the cost of capital, if cost of capital is high, profits will be lower. Good credit score will have positive impact on the success of business for the opposite reason, lower cost of capital.

- **White Collar Percentage**
  White collar percentage also has a positive impact on the success of business. We can assume white collar percentage is correlated to the educational level of employees. The higher educated level of a business' labor force, it is more likely to have a better success rate.

- **Small Business**
  The small business factor is a negative sign. If the size of business is small, it is usually harder for them to do capital raise and other investment inputs. They also may not be as competitive price wise to larger retailers that get better deals from suppliers. That is the important reason Business Incubator can help those smaller sized company to share technology, business training and other resources together.

Zip Code Regression Tables

Regression analysis was calculated on the top 6 zip codes in Paterson, New Jersey based on the different independent variables with log sales being the dependent variable. The bottom 6 were not analyzed as the location sales volume were tremendously lower than the top 6. They are ranked based on actual location sales volume.

Table 12: Zip code 07501 Var: log sales vol

	Coefficients	*Standard Error*	*t Stat*
Intercept	-7.8414395	0.28127205	-27.878488
YEAR FIRST APPEARED IN YELLOW PAGES	-0.0128218	0.00299489	-4.2812129
CREDIT SCORE	8.52780393	0.36333571	23.4708661
WHITE COLLAR PERCENTAGE	1.10383451	0.06803076	16.225521
SMALL BUSINESS	-0.4438988	0.04802067	-9.243911
OBS	3,062		

Credit score and white-collar percentage are both significant. The year established has a negative correlation because the older businesses may be less technology centered. They may not have the same social media marketing than the newer business. Small business centered is playing a negative role, the smaller businesses, the less sales. A local hardware family-owned hardware store may not be able to compete with the prices of Home Depot, making it hurt the small business. 3,062 observations were taken in this zip code.

Table 13: Zip code 07503 Var: log sales vol

	Coefficients	*Standard Error*	*t Stat*
Intercept	-7.2250061	0.28850544	-25.042876
YEAR FIRST APPEARED IN YELLOW PAGES	0.00118786	0.0032773	0.36244998
CREDIT SCORE	7.92217154	0.3721902	21.285277
WHITE COLLAR PERCENTAGE	0.64735905	0.06929138	9.34256219
SMALL BUSINESS	-0.4176334	0.05231848	-7.9825222
OBS	2874		

Credit score and white collar percentage are both positive correlation. The year first appeared in yellow pages is not significant in this zip code, the older business is the more sales volume they had. 2,874 observations were taken in this zip code.

Table 14: Zip code 07514 Var: log sales vol

	Coefficients	*Standard Error*	*t Stat*
Intercept	-7.1468858	0.35959965	-19.874562
YEAR FIRST APPEARED IN YELLOW PAGES	-0.0059202	0.00418939	-1.4131403
CREDIT SCORE	7.687848	0.47561875	16.1638877
WHITE COLLAR PERCENTAGE	0.64336477	0.09139185	7.03962923
SMALL BUSINESS	-0.1420029	0.0660874	-2.1487143
OBS	1789		

Hypothesis holds true again as credit score and white collar percentage both have a positive correlation to location sales volume as year first appeared in yellow pages and small business centered had a negative as 1,789 observations were taken in this zip code.

Table 15: Zip code 07524 Var: log sales vol

	Coefficients	*Standard Error*	*t Stat*
Intercept	-8.6537361	0.38116196	-22.703567
YEAR FIRST APPEARED IN YELLOW PAGES	-0.01575	0.00447498	-3.5195603
CREDIT SCORE	9.70045193	0.49805501	19.4766677
WHITE COLLAR PERCENTAGE	1.37340622	0.10487322	13.0958713
SMALL BUSINESS	-0.3912617	0.06864895	-5.6994559
OBS	1413		

Results hold valid as credit score and white collar percentage both have a positive correlation to location sales volume as year first appeared in yellow pages and small business centered had a negative as 1,413 observations were taken in this zip code.

Table 16: Zip code 07513 Var: log sales vol

	Coefficients	*Standard Error*	*t Stat*
Intercept	-9.3567922	0.4942182	-18.932513
YEAR FIRST APPEARED IN YELLOW PAGES	-0.0198268	0.0052254	-3.7943098
CREDIT SCORE	10.4084908	0.64101271	16.2375732
WHITE COLLAR PERCENTAGE	1.15320365	0.1175127	9.81343808
SMALL BUSINESS	-0.1663129	0.0835735	-1.9900198
OBS	1107		

1,107 observations were taken in this zip code. Same results hold true.

Table 17: Zip code 07505 Var: log sales vol

	Coefficients	*Standard Error*	*t Stat*
Intercept	-6.7391618	0.29689102	-22.69911
YEAR FIRST APPEARED IN YELLOW PAGES	-0.0259858	0.00297187	-8.7439388
CREDIT SCORE	6.92479868	0.36958293	18.7367923
WHITE COLLAR PERCENTAGE	1.15348626	0.06965982	16.5588475
SMALL BUSINESS	-0.3007445	0.0535496	-5.6161843
OBS	1998		

The results were the almost same throughout the top 6 zip codes. Credit score and white-collar percentage are both positive correlations and are significant. Year first appeared in yellow pages was mostly a negative correlation. Being small business centered needs to be improved.

SIC Code Regression Tables

Regression analysis was calculated on the top 6 SIC codes in Paterson, New Jersey based on the different independent variables with log sales being the dependent variable. They are ranked based on actual location sales volume.

Table 18: SIC Code 5172- Petroleum, Var: log sales vol

	Coefficients	*Standard Error*	*t Stat*
Intercept	-16.120695	3.93314394	-4.0986791
YEAR FIRST APPEARED IN YELLOW PAGES	-0.2460838	0.03742449	-6.5754746
CREDIT SCORE	19.4878356	4.81097943	4.05070026
WHITE COLLAR PERCENTAGE	10.3610894	1.10947885	9.33869935
SMALL BUSINESS	-0.0563914	0.60228738	-0.0936288
OBS	39		

Looking at top SIC code it shows that the year first established is once again a negative correlation to sales. Newer companies may adapt better to market changes than an old company. Old companies' business models will get beaten out by a new company that has been specifically created to deal with newer markets. Better promotions and social media advertising could help out perform other aged companies. 39 observations were taken for this SIC code.

Table 19: SIC Code 5084- Industrial Machinery and Equipment, Var: log sales vol

	Coefficients	*Standard Error*	*t Stat*
Intercept	-17.111323	2.22355178	-7.6954912
YEAR FIRST APPEARED IN YELLOW PAGES	-0.0322051	0.0093364	-3.4494176
CREDIT SCORE	13.79766	1.88091064	7.33562759
WHITE COLLAR PERCENTAGE	12.1556427	2.73778687	4.43995216
SMALL BUSINESS	-0.5693357	0.21518731	-2.6457678
OBS	53		

Hypothesis holds true as credit score and white-collar percentage are both significant and year first appeared in yellow pages and small business centered have negative correlations.

Table 20: SIC Code 8011- Offices and Clinics of Doctor of Medicine, Var: log sales vol

	Coefficients	*Standard Error*	*t Stat*
Intercept	-0.7451044	1.01924505	-0.7310355
YEAR FIRST APPEARED IN YELLOW PAGES	-0.009016	0.00418021	-2.1568371
CREDIT SCORE	3.59098185	0.731784	4.90716092
WHITE COLLAR PERCENTAGE	-2.5003998	0.90867812	-2.7516892
SMALL BUSINESS	-0.3188674	0.15859869	-2.0105298
OBS	593		

This is one of the odd cases where the white-collar percentage is a negative correlation to sales. Trying to reason this is quite difficult. I believe this could be a special case with Paterson.

Table 21: SIC Code 2099- Food Preparations, Var: log sales vol

	Coefficients	*Standard Error*	*t Stat*
Intercept	-16.707706	9.10685593	-1.8346294
YEAR FIRST APPEARED IN YELLOW PAGES	0.02672987	0.10200766	0.26203784
CREDIT SCORE	17.1151905	9.9208895	1.72516693
WHITE COLLAR PERCENTAGE	8.30092946	1.32441091	6.267639
SMALL BUSINESS	-1.3505771	1.10480347	-1.2224591
OBS	19		

Year first appeared in yellow pages had a positive correlation. More people may be going to the old restaurants that have been around for a while. If they trust their food and may be familiar with the workers, it makes sense to resort back to this "old reliable" restaurant. Being small business centered having a negative impact makes sense because people may not go to a small local deli compared to a large Applebee's even if the quality of food is better. They may not necessarily know about the deli because the Applebee's has a large brand.

Table 22: SIC Code 5047 - Medical and Hospital Equipment, Var: log sales vol

	Coefficients	*Standard Error*	*t Stat*
Intercept	0.20219251	3.20172303	0.06315116
YEAR FIRST APPEARED IN YELLOW PAGES	-0.0757139	0.02253632	-3.3596384
CREDIT SCORE	15.9682904	2.67891792	5.96072402
WHITE COLLAR PERCENTAGE	-13.19229	2.62674837	-5.0222893
SMALL BUSINESS	1.04313449	0.56905713	1.83309274
OBS	31		

Once again in the medical field the white-collar percentage is a negative correlation to sales. With 31 observations we can assume that this may be a special case towards Paterson, New Jersey, due to the ethnicity of the population and the promotion in the medical field.

DATA CONCLUSION

The hypothesis held true as the results are valid. Credit score and white-collar percentage have a positive correlation and are significant to the sales of a business. Year established in yellow pages has a mixed correlation to sales volume depending on the certain industry. Small business experience definitely needs to be improved so they can compete with the other larger businesses.

REVITALIZATION PLAN

Goal 1: Create jobs for Paterson residents

This can be done by having support activities to help residents increase their education and skills to go into the Paterson work force or start a business. Below are some examples of programs that could potentially be put into place to help Paterson residents get jobs.

GED Training
Over 25% of Paterson residents of 25 years or older do not have a high school diploma or GED. By providing GED training it can increase the education level of residents preparing them for the workforce. This may even encourage people to work for a bachelor's degree as 90% do not have one.

Skill Training
Implementing programs to increase specific skills for jobs. One of Paterson's strengths are the oil industry. Having programs to help the skills of workers to enter into the biggest market in Paterson can help spur growth. Skill training including computer knowledge could propel people into the labor market in different fields.

Job Incentives
Providing incentive for Paterson employers to hire Paterson residents. By employing Paterson residents, the money will be staying in the city increasing growth.

Goal 2: Improve housing and the city

The infrastructure in Paterson is extremely outdated. With the house value $100,000 less than the average in Passaic county, there is a lot of room for growth.

Repair and update vacant infrastructure
Much of the infrastructure is old and outdated. With the improvement of this space, the property value will increase and the quality of the city. These empty buildings can be used for NEW businesses or hold tenants to raise income for the city.

KEY OPPORTUNITY AREAS AND SECTORS

Key opportunity areas and sectors are certain aspects within the city that the can be focused on to incorporate incubators. With nearly 80% of the business being in 6 zip codes, it makes sense for incubators to focus in on these areas, primarily zip code 07501.

Financial and business education incubators can be put into place to help grow businesses in highly business populated zip codes. Providing education to help expand the knowledge of these will result in higher success rate. Financial education will teach business owners about the importance of credit score. By realizing the importance of a business keeping a high credit score, they'll receive a better loan rate. Loan impacts the cost of capital, if cost of capital is high, profits will be lower.

CONCLUSION AND POLICY RECOMMENDATIONS

Previous literature also identified factors that contribute to the success rate of BI, such as infrastructure, human and financial resources used as well as labor productivity of graduates (Hackett and Delts 2004b). Other findings suggest educational levels of incubating managers also has a significant impact on the result. In our research, we need to consider the local environment and study what factors will help to improve the performance of BI in Paterson.

With our collection of all business data of Paterson from 2015-2018, we have identified re important to the successfulness of Paterson' local business. For example, credit score and white-collar percentage all contributed positively to the success of business sales volume. Paterson is unique and different zip codes areas are very different. Lack of business experience with small size business needs to be improved in the future.

Business incubators as a real options project can be evaluated as an economically competitive project. The theoretical justifications for the existence of incubators are rooted in market failure arguments (Hackett& Dilts, 2004a) and public good (Arrow, 1963). In order to integrate factors affecting BI to predict and explain incubation outcomes, a real options theory has been proposed by Hackett in his dissertation. We will try to use real options theory to analyse the economic cost and benefit for a BI in Paterson as well as the social impact on Paterson's economic renewal program.

Paterson has its unique features. From our analysis, government need to implement BI according to the feature of each zip code. We suggest different types of BI for individual zip code. Setting up several smaller sized BI will help Paterson local business owners to have a better training in capital investment, technology skills development, legal education and others. BI will help local community to grow in a business environment with a higher successful rate.

REFERENCES

Chandra, A., He, W., & Fealey, T. (2007), Business incubators in China: A financial perspective, *Asia Pacific Business Review*, *13*(1),.79–94.

Dahms, S., & Kingkaew, S. (2016). University business incubators: An institutional demand side perspective on value adding features. *Entrepreneurial Business and Economics Review*, *4*(3), 41-56.

Dozier, M. (2003, Feb 27). East metro business: BUSINESS PROFILE: Incubator assists success of firm: [Home edition]. *The Atlanta Journal – Constitution*

Dunne, T., Roberts, M., & Samuelson, L. (1988). Patterns of firm entry and exit in U.S. manufacturing industries. *Rand Journal of Economics*, *19*, 495-515.

Hackett, S. M. & Dilts, D. M. (2004b). A systematic review of business incubation research. *Journal of Technology Transfer*, *29*, 55-82.

Incubator Report (2016).

KOO, J. (2018). Does early incubating improve the performance of start-ups?: Evidence from TIPS in Korea. *KDI Journal of Economic Policy*, *40*(2), 75–96.

Mallach, A., & Sterner, D. (2008), New Jersey and Its Cities: An Agenda for Urban Transformation.

Mian, S. A., Assessing Value Added Contributions of University Technology Business Incubators to Tenant Firms, *Research Policy*, *25* (1996), pp. 325-335.

Meindersma, S. (2012, Oct 28). MBI business incubator boasts a high success rate: 59 companies have 'graduated'. *Telegram & Gazette*

Mullin, J., & Kotval, Z., (2003). Measuring the effectiveness of downtown revitalization strategies. *NYCOM Bulletin*, 23.

Olson, T., & By, T. O. (2014, Feb 23). Incubator boasts huge success rate. *Tribune-Review/Pittsburgh Tribune – Review*

O'Neal, T. (2005). Evolving a successful university-based incubator: Lessons learned from the UCF technology incubator: EMJ. *Engineering Management Journal*, *17*(3), 11-25.

Pearson, B. (2009, Apr 05). Tyler's business incubator helps business owners hatch big plans.*McClatchy - Tribune Business News*

Reynolds, P. D., Bygrave ,W. D., Autio, E., Cox, L. W., & Hay, M. (2002), Global Entrepreneurship Monitor, *Executive Report*, as quoted in *NBIA (2009)*, What is Business Incubation?

Totterman, H., & Sten, J. (2005). Start-ups: Business Incubation and Social Capital. *International Small Business Journal*, *23*(5), 487-511.

Zhang, H., & Sonobe, T. (2010). Business incubators in China: an inquiry into the variables associated with incubatee success. *Economics: The Open-Access, Open-Assessment E-Journal*, *5*, 7.

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National Association of Business, Economics and Technology

43rd Annual Meeting

October 22 and 23, 2020
Virtual Conference

Official Conference Program

Thursday, October 22

Session 1: 8:00 am - 8:30 am

Chairs:

Norman Sigmond
Kutztown University of Pennsylvania

Adnan Chawdhry
California University of Pennsylvania

Welcome

Loreen Powell
Bloomsburg University of Pennsylvania
President and Conference Director, NABET

NABET Conference Proceedings and JBET Information

Norman Sigmond
Kutztown University of Pennsylvania
Chairman, NABET Board and Co-Editor of Conference Proceedings and JBET

Jerry D. Belloit
Clarion University of Pennsylvania (Retired)
Vice-Chairman, NABET Board and Co-Editor of Conference Proceedings and JBET

Session 2: 8:30 am - 9:30 am

Economics

Chair:

John D. Grigsby
Thomas Jefferson University

The Long Run Impact of Pennsylvania's Fracking Boom on Local Residents'Income

David Latzko
Pennsylvania State University-York

This paper presents a case study investigation on the effects of the Pennsylvania frackingboom on the incomes of local residents. Regions of the state that experienced high levelsof drilling activity have an annual income per taxpayer 10 to 20 percent higher than a comparable synthetic control without fracking activity. In the long run the component of residents' income most impacted by fracking is royalties received by the landowners of

drilling sites. Fracking has had a far more modest, fleeting effect on the economies ofrural areas of Pennsylvania with small or moderate numbers of wells drilled.

An Empirical Assessment of How Covid-19 Lockdown Measures Impacted theSales of Electricity to the Commercial Sector
Penina Orenstein
Seton Hall University

Thomas Browne
Seton Hall University

Beginning in late March, the lockdown measures imposed by state governments had dramatic and far-reaching economic effects. As activities considered to be non-essential,both private and public, were ceased, the Commercial sector was impacted as businesses and governments curtailed or ceased normal operations. This analysisexamines the energy consumption in the form of the sales of electricity to the Commercialsector in light of several forecasting methods to assess the impact of the lockdown.

Session 3: 8:30 am - 9:30 am
Pedagogy
Chair:
Cori Myers
Lock Haven University

Compelled Online Due to Covid-19. Perceptions of First-time Online Students
Brian Trout
Millersville University of Pennsylvania

In Spring 2020, colleges and universities across the globe transitioned to online learningin response to the coronavirus pandemic. Students who had enrolled in face-to-face courses were moved online, many for the first time. How this forced exposure to online learning will impact students' attitudes toward distance education is a trending topic of discussion. Some contend the conversion will accelerate adoption of online education while others believe it could hinder acceptance. While distance learning literature has examined factors that influence students' decisions to enroll in online courses and perceptions of their experiences, no studies have examined these topics in such extraordinary circumstances. The students included in this study had never taken onlinecourses before being compelled to do so during the coronavirus pandemic. Their feedback is invaluable as universities plan their online offerings in a period of tightening budgets and retention concerns.

Evaluation of a Synchronous Roleplaying Module for Deeper Learning on a Video Conferencing Platform in Higher Education

Audrey Pereira
Fitchburg State University

Online teaching faces the challenge of using roleplaying as a tool to promote cognitive rehearsal (CR) and skills acquisition in management. COVID-19 has forced many face- to-face (F2F) higher education courses to go online, adding to the challenge. However, in the face of COVID-19, many educators have quickly adopted Zoom and similar videoconferencing platforms (VP) to carry on synchronous education. Roleplaying over aVP could promote CR and skills acquisition in an online learning setting. Research shows that studies on activities that promote deeper learning principles (DLPs) have historicallybeen less likely to be done in an online setting. We propose to use and evaluate a synchronous, roleplaying module administered over a VP to a class of undergraduates studying the social and political environment of business as an aid to improving understanding the diverse social and political perspectives of various stakeholders in business.

Transition to Online Learning: Business Student Perspectives During theCoronavirus Pandemic

April Bailey
University of South Florida

This paper reports the experiences of business students at a public four-year institution through the transition to online instruction during the Coronavirus pandemic. Specifically, this paper explores results of transitioning a face-to-face classroom to an online learningmodality to finish the spring 2020 semester. Results from this study are important not only to the College of Business's but also to the other Colleges as interest in university communication, and instructional delivery has universally changed in order to better servestudents' needs. Students reported 75.8% agreed or somewhat agreed that the Universityhad communicated well to them about changes to their education due to the coronavirus. Analysis shows that students who express stronger preference for in-person instruction are more likely to agree that they are stressed out. The correlation between confidence in online learning and the stress of taking online courses is statistically significant. Additionally, male students expressed more confidence in studying online than female students. Senior-level students reported being less stressed out and have more confidence in online learning.

Session 4: 8:30 am - 9:30 am
Blockchain/Digital Currency
Chair:
Linda Hall
State University of New York-Fredonia

Analysis of Efficiency in Partial Data Verification: Blockchain Hash Functions &Merkle Trees
Loreen Powell
Bloomsburg University of Pennsylvania

Daniel Powell
North Pocono School District

The COVID-19 pandemic has propelled many organizations into telework/e-work. As the electronic delivery of information and work continues to alter our existing financial, legal,health, and educational worlds, the need for secure online data verification increases. Blockchain's hash functions for data verification makes it very desirable for organizations to use to secure and verify online data. However, the complexity, newness, and lack of experienced blockchain professionals often impedes it's use. As a result, many researchers and organizations seek innovative ways to reduce data verification without reducing the security. This paper focuses on partial online data verification via blockchain Merkle trees. An in-depth analysis of Merkle trees and a novel approach for using Merkel trees for partial blockchain online data verification is presented.

The Mobile Open Blockchain Initiative: Is it Really Green IT
Loreen Powell
Bloomsburg University of Pennsylvania

Michalina Hendon
University of the Cumberland

Blockchain innovations and initiatives are becoming vast and wide. One of the newest initiatives is the Mobile Open Blockchain Initiative (MOBI). MOBI's goal is to promote technological advancement in the motor vehicle and transportation production industry while still protecting the environment. The creation of various smart technologies has enabled the organization to continually realize this goal. However, many smart technologies and blockchain data warehouses have led to concerns about environmentalconservation. Research is limited on the sustainability impact on utilizing blockchain across multiple intelligent transportation stakeholders and computationally expense and effect on the environment from using such technologies. This research utilizes the fuzzy, DEMATEL and ISM set theories to explain how blockchain-based intelligenttransportation is computationally expensive for our environment.

Using UTAUT for Blockchain Assessment

Andrew Mangle
Bowie State University

With over 1000 public and private Blockchains (coinmarketcap.com, 2020) an acceptancemodel can facilitate an objective and comparative assessment of existing and future solutions. The paper outlines an assessment framework based on Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al. (2003)) using distinguishing characteristics of blockchain implementations: trust, utility, and support. Trust is one of the promises of Blockchain (Economist, 2015) and a paramount construct of a decentralized autonomous software architecture. Utility are the functional attributes of the software architecture, while support are the nonfunctional attributes. Utility includes scalability and security that align with the UTAUT constructs performance expectancy and effort expectancy. Support includes governance and ecosystem that align with the UTAUT constructs facilitating conditions and social influence. The distinguishing characteristics trust, utility, and support in the context of UTAUT are beneficial for comparing and evaluating the myriad of blockchain implementations. The research encourages the examination of existing and future solutions using the UTAUT-focused attributes. The research has broader implications for blockchain solutions by providing contextual constructs necessary for use and adoption. With over 1000 public and private Blockchains (coinmarketcap.com, 2020) an acceptance model can facilitate an objective and comparative assessment of existing and future solutions. The paper outlines an assessment framework based on Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al. (2003)) using distinguishing characteristics of blockchain implementations: trust, utility, and support. Trust is one of the promises of Blockchain (Economist, 2015) and a paramount construct of a decentralized autonomous software architecture. Utility are the functional attributes of the software architecture, while supportare the nonfunctional attributes. Utility includes scalability and security that align with the UTAUT constructs performance expectancy and effort expectancy. Support includes governance and ecosystem that align with the UTAUT constructs facilitating conditions and social influence. The distinguishing characteristics trust, utility, and support in the context of UTAUT are beneficial for comparing and evaluating the myriad of blockchain implementations. The research encourages the examination of existing and future solutions using the UTAUT-focused attributes. The research has broader implications for blockchain solutions by providing contextual constructs necessary for use and adoption.

Session 5: 8:30 am - 9:30 am

Marketing and Sales

Chair:

David Jordan
Slippery Rock University of Pennsylvania

Assessing the Impact of eWOM on ECommerce at Amazon.com

Laura Gurney
Husson University

Indira Guzman
Trident at AIU

Using Information Diagnosticity constructs to augment the e-commerce technology acceptance model (eTAM), the research model in this study extends the predictive accuracy of online purchase behavior by accounting for influences derived from electronicword-of-mouth (eWOM). Additional insights into buyer decision making through online sales vendors, such as Amazon.com, were assessed. The data analysis conducted usingSmartPLS of 218 online shoppers indicates that the new eTAM assesses trustingtendencies influences on purchase behavior. This research indicates a shift in technologyacceptance behavior antecedents from usefulness to trust. In an age where online personal information and financial data breaches are in the news often, trust in the ecommerce process is a significant aspect of online commerce adoption and purchase intentions. The extension of eTAM via information diagnosticity strengthens predictive aspects of the model in the ecommerce environment.

Exploring the Relationship between Brand Humanization Personality andAuthenticity During the COVID-19 Pandemic

Kuan-Pin Chiang
Central Connecticut State University

The Covid-19 pandemic is unlike any other crisis that the world has experienced before.This uncertainty has forced businesses to maintain and build relationships with consumers who have changed their priorities and preferences in life. Consumers feel fearand anxiety. Previous research suggests that the feelings of fear and anxiety can triggera desire of affiliation, increasing consumers' emotional attachment to a brand when the brand share the same emotional experiences. To effectively build and maintain relationships with customers during this unprecedented time, taking on a human-centric approach by humanizing brands could help in gaining consumer trust and further strengthen brand authenticity. Therefore, the objective of this study is to explore whetheran increase of brand-consumer interaction on social networking sites (SNSs) during the pandemic could influence consumers' perception on brand humanization and its effects on the relationship between brand humanization, personality and authenticity for empiricaltesting.

Student Reactions to the Use of Technology in Online Experiential MarketResearch Courses

David DiRusso
Millersville University of Pennsylvania

The purpose of this paper is to offer student reactions to performing personal interviews,focus groups and surveys using technology and non-contact methods in anundergraduate Marketing Research course. Feedback from 8 student groups (40 students) total was solicited in the Fall 2019 and Spring 2020 semesters. Students wereoffered multiple options to implement these forms of research and commented on the efficacy of each. Implications for general online teaching of marketing research and teaching the course during COVID restrictions are offered.

Session 6: 9:45 am - 10:45 am

Triple Bottom Line
Chair:
Lisa Walters
State University of New York-Fredonia

Organizational Awareness and Implementation of Sustainability Activities inBusinesses: Moving Toward the Circular Economy

Maung Min
Pennsylvania State University - Lehigh Valley

Denise Ogden
Pennsylvania State University - Lehigh Valley

Jeffrey Stone
Pennsylvania State University - Lehigh Valley

In the past decade, sustainability programs have played a larger role in strategic planning. More recently the ideas around the "circular economy" have gained momentum. The circular economy recognizes the limits to linear consumption and replaces the outdated model with a shift to renewable actions. While many business professionals use the terms associated with the circular economy, their company actionsare often limited to waste and recycling. This paper explores sustainability and circular economy awareness and activities used by businesses. A survey was developed to determine awareness of sustainability and circular economy concepts and whether activities around the circular economy are limited to waste and recycling.

Business Embracement or Not of the United Nations Sustainable DevelopmentGoals: An Industry Study

Maung Min
Pennsylvania State University - Lehigh Valley

In 2015, the United Nations (UN) developed 17 Sustainable Development Goals (SDGs)to achieve a better and more sustainable future for all. The goals were adopted by all 193

UN members and provided a shared blueprint for present and future peace and prosperityfor people and the planet (i.e., triple bottom line), to be achieved by 2030. However, have companies incorporated the SDGs into their sustainability activities and goals? This studyanalyzes the health care industry.

To examine the extent of adoption of specific SDGs we obtained a dataset from the Governance & Accountability Institute, Inc, a private sector sustainability consulting organization. Mapping was performed by analyzing the sustainability and Corporate Social Responsibility (CSR) reports of 61 health care companies. Our study finds that adoption of these goals by the industry players vary and not necessarily dependent on their size. There is also not a relationship between company CSR performance with adoption of the goals. We intent to further analyze the motivation for companies to embrace the SDGs.

Combating Covid19 Information Technology Stress: A Framework of Mindfulness& Emotional Intelligence Strategies

Michalina Hendon
University of the Cumberlands

Margaret O'Connor
Bloomsburg University of Pennsylvania

In today's COVID-19 business environment, many employees have been forced into a telework environment. However, teleworkers are expected to be information technology (IT) literate. This may not be the case for many new COVID-19 teleworkers. This paper argues that today's teleworkers may be experiencing emotional work exhaustion/stress as a result of the added IT issues and expectations beyond their typical job duties. A framework regarding mindfulness and emotional intelligence (EI) strategies is provided as a possible solution for organizations to aid in COVID-19 employee IT stress.

Session 7: 9:45 am - 10:45 am

Accounting/Financial Literacy

Chair:
Cori Myers
Lock Haven University

From the Sacred to the Profane: Religious Organizations in the Tax Court

Michael Coyne
Fairfield University

Ahmed Ebrahim
Fairfield University

The main goal of this paper is to analyze and classify taxation issues litigated in the courtsystem that involve tax-exempt religious organizations. The paper highlights the main arguments presented by religious organizations and government/taxation authorities andthe general tendency of court rulings. The paper will not focus on pure non-tax constitutional issues such as separation of church and state and the establishment clauseunder the first amendment. Rather, the paper will focus on court disputes related to different types of taxes.

The tax issues highlighted in this paper include (but are not limited to) the following:

- The tax exemption of the religious organization when the IRS denies its initial application or revokes a previously granted one.
- Imposing income tax on a tax-exempt religious organization when part of itsincome is deemed unrelated to its mission and taxable under the UnrelatedBusiness Taxable Income (UBTI) rules.
- The courts' rulings on self-employment tax exemption granted to "ministers"and religious workers.
- The courts' rulings on payroll withholdings when taxpayers (employees or employers) refuse to withhold Social Security and Medicare from salary payment based on religious beliefs and first amendment rights.
- The courts' rulings on taxpayers' refusal to pay part or all their income taxesbased on religious beliefs and first amendment rights such as their refusal tofight in or fund a war.
- Imposing a local sales tax on religious organization's publications of "sales"deemed unrelated to its mission.

FINFO's the App, But Where's the Map? Financial Literacy & Locational Analytics

Thomas Mueller
California University of Pennsylvania

Alex Dalton
California University of Pennsylvania

Edmund Matecki
California University of Pennsylvania

James Ola
California University of Pennsylvania

FINFO is the name of a financial literacy mobile phone app developed for and by students,under the direction of faculty at California University of Pennsylvania. As winner of the $5K second-place prize at the 2020 PASSHE State System Startup Challenge, thedevelopers of this App are creating short-video based tutorials on personal finance.

Operating as a non-profit, the FINFO development team wants to maximize the utility oftheir limited resources by conducting a beta test of the app in a local region. In this pilot study, we will assist the FINFO development team by using locational analytics to ascertain which geographic school district could most benefit from no cost, mobile phone based financial training. By exploring relations between publicly available demographic data such as homeownership, household income, community financial institutions, education levels, mobile phone adoption, etc. we seek to identify correlations that can improve the design and creation of effective content for the FINFO App.

Session 8: 9:45 am - 10:45 am

Innovation, Technology, and Strategy
Chair:
Linda Hall
State University of New York-Fredonia

State of Augmented Reality and Virtual Reality
Gerald Wright
Husson University

Many businesses are leveraging augmented reality (AR) and virtual reality (VR) to open new channels of customer service. In augmented reality, users interact with computer- generated artifacts integrated into their real-world view. This is often accomplished through commonly use technology such as smartphones and tablet computers. A more immersive experience is virtual reality. Where the user is placed within a three- dimensional alternative environment; however, this immersive experience comes at the cost of more expensive technology, usually in the form of sensors and a helmet or visor.

Through this exploratory study, we will examine the current state of augmented reality and virtual reality. First, we will discuss the present and near-future capabilities of AR/VR. From there, we will briefly explore the market hype surrounding the technologies. Then, we will study how widespread is the use of AR/VR within various business sectors. The final result will be a set of action items for businesses that wish toimplement AR/VR.

How Cultural Heritage Institutions (Chi) Around the World Have Evolved Duringthe Covid-19 Pandemic
Gerard Martorell
Lock Haven University of Pennsylvania

Mathilde Betoret
Centre de Cultural Contemporània de Barcelona

The COVID 19 pandemic has created a great challenge to many kinds of organizations in general and also to organizations which business model is based on exploiting some kind of Cultural Heritage. In many places around the world those organizations were mandated to lockout. During social isolation, technology might have been the tool to maintain their activity alive. The aim of this article is to highlight how this evolution was carried out at different Cultural Heritage

Organizations around the world in Spring- Summer 2020. The methodology has been exploratory, using in-depth interviews at a number of institutions on three continents. The structure of the comparison is based on presenting each one of them; identifying the pre-pandemic degree of used technology byeach institution; explaining the changes introduced during the pandemic, and what are the future evolution they are aiming at.

Modeling Short Time Period Car Redistribution Policy in Car Sharing Industry
Wei Chen
York College of Pennsylvania

Economic, environmental and social impacts have increased popularity of car sharing program. More firms consider entering this market to satisfy rising demands from public.In general, a car sharing company faces two very practical problems: 1). Station Size/Capacity; 2). Strategies for imbalance of vehicles distribution for each station. Although literature presents that such questions have been studied in the past, almost allof them use optimization models to address these questions; and the problem of those optimization models is these optimization models are specifically question-oriented, therefore it is difficult to be implemented in practice and cannot be easily generalized in common situations. In this study, we develop a novel model to address these questions.Our models require few inputs and offer quick analytic results. An application of the models on Zipcar illustrates how our models work and shows that our models perform well, achieving expectations.

Session 9: 9:45 am - 10:45 am
Higher Education
Chair:
John D. Grigsby
Thomas Jefferson University

A Longitudinal Study of GenZ-Their "Fifth Truth" about their Workplace Valuesand Implications for Higher Education Career Ready Preparation
Celia Lofink
University of Hartford

There are various terms used to describe the latest generation of Millennials – most popular being GenZ. In a recent report of the Chronicle of Higher Education (2019), Jeffrey Selingo wrote about the *"New Generation of Students; How colleges can recruit teach and serve GenZ"*. He found several distinct traits present specific to the GenZ thatthis researcher used as the basis of this current research. For example, Millennials are said to be attached to technology in comparison to all previous generations. They value

their parents' opinions and their core values are said to be more family and community oriented – with a sense of civic duty and intention to bring change to the world. This researcher will add further study of the literature to include research done on this GenZ millennial's perception of their transition from college to career. Focus will be given specifically to what they view as their workplace values and the implications of career preparation programs during their time in higher education.

The researcher seeking these funds has been collecting data for the past six years on theconcept named by the researcher as the millennial's "*fifth truth*". Beginning in the Fall of 2014 this researcher began collecting data from up to 100 students each semester usingan assignment that was stated to the students as follows:

Watch a short video about millennials at work. (link was provided to students). The panelist in the video highlights FOUR truths about millennials. It's a new generation (saygoodbye to the old Millennials Gen Xers and Ys and hello to GenZ)! You are a member of the GenZ - Post what you believe is the FIFTH truth about YOU as a Gen Zer - what do you want to tell the world is the most important truth about you at work?

The study analyzed the data collected based on the following two research questions:

Does the analyzed date confirm or reject current thinking regarding GenZ and their perceived workplace value? And,

Are there implications about innovations in teaching for ultimate career preparedness based on the conclusions regarding GenZ perceived workplace value?

Student Loan Debt Meets Gen Z
Diane Galbraith
Slippery Rock University of Pennsylvania

The exorbitant amount of student loan debt in America has been widely documented. Universities are burdened with rising costs and lowered student populations. In addition, each generation brings their own unique and new set of attributesto the university scene as well as the workplace. Generation Z is a generation marked bymore fiscal stewardship, so student loan debt presents an interesting quandary. This paper will examine first generation students vs. their counterparts through the lens of thismore recent Generation Z to determine debt levels, success rates, measured by major, graduation rates, GPA and debt levels.

The Impact of Freshman Experience Courses on Higher Education Business Students' Decision to Return for a Second Semester: A Research Study Proposal
Luanne Amato
Holy Family University

First year experience courses were created and implemented in higher education to helpsmooth the transition for incoming Freshman from all walks of life. These courses were designed to encourage persistence, promote high academic performance, and foster socialization, ultimately leading to successful degree completion (What WorksClearinghouse, 2016.). In the United States, business recruiters seek higher education graduates who are diverse and possess the necessary skills to foster economic sustainability in the global marketplace (Erickson, Stone, & Weber, 2010). Research statistics report that in the United States 30% of freshman students enrolled in higher education will drop out before sophomore year (Bustamante, 2019). This proposed research study, using interviews and surveys of recent higher education freshman who completed a Freshman Experience course, examines insights into how the course influenced students, from a diverse population with a declared business major, decision to return to the college or university the following semester.

Session 10: 11:00 am - Noon

Economics

Chair:

Joshua Chicarelli
California University of Pennsylvania

A FiveRinged Market: A Regression Analysis of the 2002 Salt Lake City Olympics'Impact on Home Values using Data Analytics

Bradley Congelio
Kutztown University of Pennsylvania

There exists an abundance of scholarly research on the impact of the modern Olympic Games on host cities. However, incredibly little amounts of this research has been conducted on the relationship between Olympic host cities and home values. The research that does exist uses limited data to reach conclusions.[1] This paper seeks to further fill this gap in sport business studies by using big data analytics and the R programming language to produce regression analyses models of the 2002 Salt Lake CityOlympic Winter Games' impact on home values in the greater Salt Lake City area. Specifically, by utilizing access to the Zillow Application Programming Interface (API), thepaper is able to examine over 9.1 million points of data pertaining to home values betweenthe years of 1996 and 2020. By subsetting the data using tools suchas tidyverse and dplyr, this paper is able to provide a micro-focus on the greater Salt LakeCity area to determine if the hosting of the 2002 Olympics Games, or the construction of three new venues for the Games, had an impact on home values.

The Cruise Industry Today: Norovirus Reality or Nonsense

Denis Rudd
Robert Morris University

In the setting of close quarters like a cruise ship a stomach bug can become a mini- disaster. Media reporting often shows the ship being cleaned after the ship makes port. Although necessary, medically speaking this is in reality a show. A show to make peoplethink that the ship is now "safe". It is a well performed deception. The significant transmission vector for this disease is not the ship. The true origin is usually avoided by both the media, general public and the cruise lines. The cruise line avoids the truth, probably deliberately. In the media's case it is more likely poor understanding of an unfamiliar disease. The ship is not the problem, the crew is.

What Is A House? The Pertinacious Question About Housing and EconomicDevelopment
Samuel Enajero
University of Findlay

The debate on the hypothesis that massive housing construction is the starting point of economic development has been ongoing since the end of World War II. Proponents of this hypothesis believe that housing serves as an impetus for economic development, and there is enormous practical evidence to support this view. Opponents, however, state that housing is not a cause but a consequence of development. This latter group, in line with mainstream economics, categorizes housing to be a private consumer good, such as automobiles, clothing, food and furniture. The purpose of this study is to clarify the debate and show that massive housing construction per se is not a panacea for economic development. However, the private and public goods, complementary tohousing, which eliminate social costs and produce a conducive environment for capital accumulation and productivity, are the stimuli for sustainable economic development andgrowth. Thus, the debate should be about the definition of a house—is a house an economics consumer good or a political good?

Session 11: 11:00 am - Noon
Finance
Chair:
Cori Myers
Lock Haven University

The Determinants and Evolution of Ownership Structure: Evidence from Spinoffs
Thuy Bui
Slippery Rock University of Pennsylvania

This paper examines the determinants of firms' ownership structure from a sample of corporate spinoffs. Spinoff transactions offer an interesting empirical design to study ownership structure because after the pro-rata distribution of shares from the new publiclytraded unit firm to existing parent shareholders, both parent and unit firms have the exactly same ownership structure. By tracking the ownership structures of these two sets

of firms that start at the same point on ownership structure at the time of spinoffs, I find that firms change their ownership structure to fit their firm characteristics over time. Spunoff firms are newly public firms so their ownership is more concentrated, while mature parent firms are more diverse and institutional-oriented. Results in this paper provide evidence on the determinants of firms' ownership structures and their evolution over time.

Analyst Recommendations: Evidence on Hedge Fund Activism and ManagerialAbility
Xiaohui Yang
Fairleigh Dickinson University

Yan Yan
Fairleigh Dickinson University

This study investigates analysts' attitudes toward the conflicts between hedge fund activists and target firm management by examining the impact of managerial ability on analyst recommendations around hedge fund activism. We find that analysts are more likely to reiterate recommendations and less likely to downgrade recommendations for target firms with high managerial skills following the arrival of hedge fund activists. This may be because analysts could recognize advantages associated with target firm management's superior ability that enables them to avoid costly fights with hedge fund activists. We also show that stronger managerial ability is associated with the higher analyst forecast accuracy during hedge fund intervention. Collectively, our evidence supports the positive impact of managerial ability on analysts' opinions over the course of hedge fund activist campaign and sheds light on the information gathering and processing ability of financial analysts.

Does Firm Age Affect Cash Policies?
Rajeeb Poudel
Western Oregon University

Ravi Jain
University of Massachusetts-Lowell

Luo Haowen
Purdue University-Fort Wayne

This study investigates the linkages between firm age and cash holdings. We document that younger firms keep more cash and that they have higher propensity to save cash from their cash flows in comparison to older firms. These linkages are robust to controllingfor firm size, and other control variables known to affect cash policy. Our finding is

consistent with the idea that younger firms face more financing frictions than older firmsand hence have stronger need to save cash.

Session 12: 11:00 am - Noon
Leadership and Behaviors
Chair:
Norman Sigmond
Kutztown University of Pennsylvania

Anticipating Potential Misbehavior By Startup Founders
Maheshkumar Joshi
George Mason University

Sujay Swain
Montgomery Blair High School

Our primary argument is that the recent rise in unrealistic valuations of technology based startups with a high infusion of funding from the venture capital firms (Zörgiebel, 2016) may have created conditions that gives rise to misbehaving startups. Ritholtz (2020) reports in an opinion piece appearing in Bloomberg Publication, that Grubhub bought updomain names of restaurants (of its partners) without their permission or knowledge so that if these restaurants wanted to start their own delivery business they would be blockedby Grubhub. Same report suggests Yelp is engaging in an extortion of its clients by manipulating the reviews. DoorDash, another food delivery firm was found to retain the tips that were given to the delivery person by the customers.

Although such prevalence of the misbehavior is at the organizational level, our focus in the current research paper is the founder of the firm. Popular media has created a myth that in the early startup phase the firm is identified by its founder, such as Mark Zuckerberg and Facebook, Elon Musk and Tesla, Travis Kalanick and Uber. Lowrey (2019) in the Atlantic magazine, states: "In tech, it is taken as a given that genius companies start with genius founder… Such founders tend to come with a singularity of vision, a disregard for entrenched business practices, and boundless creativity. They aredisruptors, their businesses earthquakes that change how things are done… Such disruption, obsession, and creativity often translate into real, outsize returns for investors,studies have found." However, she also suggests that "countervailing research shows that founders tend to make terrible managers, leading to worse business performance." An extreme example of such behavior resulted in Elizabeth Holmes being indicted with respect to defrauding the investors of Theranos, a firm that she founded when she was 19 years old (the trial is delayed due to the COVID pandemic). Prior to these charges, according to Ableson (2018), in a New York Times article, reported that federal regulatorshave in the past charged Ms. Holmes, too. For instance, "Last March, the S.E.C. chargedMs. Holmes with widespread fraud, accusing her of exaggerating — even lying — abouther technology while raising $700 million from investors. In announcing the charges, the S.E.C. said that Theranos and Ms. Holmes had agreed to a settlement, with Ms. Holmes agreeing to pay a $500,000 penalty. She and the company did not admit nor deny the allegations."

Existing literature in the management field has tried to explain such behavior using a variety of lenses. Mishina et al (2010) suggest that such behavior may arise due to one of three aspects: a) loss aversion, b) house money effect, and c) executive hubris. We build on these concepts and argue that investors themselves may have a high levels of expectations with respect to returns on their investment and therefore are driven by lossaversion. Their loss aversion leads them to not tie down or restrict the genius founders who are supposed to be disruptive in creating innovative firms and thus resulting in poorgovernance practices by the investors. Whereas the founders themselves may be so enamored by the pouring of VC money for their ideas that they get into the spell of playingwith "house money" (a term used in gambling, where a situation that requires little or no financial risk incurred by the founder). And we also suggest that executive hubris may berelated to narcissistic tendencies.

On the other hand, while highlighting negative aspects of Narcissism in general, Grijalvaand Harms (2014) suggest that narcissism does have some potential benefit when it comes to entrepreneurship, because narcissism might be the generator of motivation andthe requisite will power necessary to support the entrepreneurial activity. Narcissism maybe seen as a personality trait includes behavior focused on "excessive self-admiration, arrogance, perceptions of entitlement, and hostility toward external criticism" (Navis and Ozbek, 2016:110). In summary, narcissistic individuals, when operating as entrepreneursor founders may express risk taking and motivation to create an enterprise and these may be considered as positive aspects of entrepreneurship and sometimes they express more negatives traits such as arrogance, and a sense of entitlement.

Additionally, in innovation and entrepreneurship literature, researchers have linked the construct of locus of control (LOC) with CEOs' need for achievement and flexibility, an increase product innovation, risk taking with respect to new product development or reorienting the business models (Hoskisson et al, 2017). As such we combine the narcissistic trait with locus of control (external or internal) to understand which foundersmight be likely to misbehave and which one will not. We suggest that if the LOC and narcissistic tendencies are combined together, we can create four distinct types of founder entrepreneurs. Once the typology is explained in the detail, it will become easy to identify specific governance plans to provide a better monitoring/controlling of the founder entrepreneurs. Such a typology will also allow to manage the conditions that havecreated a breeding ground for misbehaving entrepreneurs (founders) because the investors (particularly VC backed investments) are interested in receiving unrealistic higher rates of return of their investment, particularly among technology firms. These highreturns come at the cost of monitoring and supervision of the founders who might have abright idea but also have a very limited life experience in managing high expectations. The case of Ms. Holmes of Theranos reflects this very clearly as discussed in the introduction section. As the next steps towards the development of the full manuscript, based on our typology of four types of founders (provided on the next page), we will offer different governance approaches for each different types of the founder (when the full manuscript is ready, not presented in this abstract).

Propositions will be offered to suggesthow to manage the corporate governance o that a founder's negative impact due to the narcissistic tendencies be managed and restrained.

Factors that Contribute to Social Engineering: An Interdisciplinary Perspectivefrom Information Technology Psychology and Business

Amy Washo
Marywood University

Social engineering is the act of using manipulation and deception to obtain accessto confidential information. It is considered one of the leading threats to information security today. The topic is complex and increasing in prevalence among individuals andbusinesses. This paper explores the subject of social engineering from an interdisciplinary perspective. A literature review from the information technology, psychology, and business disciplines explains the interconnected nature of the topic as well as the necessity to comprehend it from multiple viewpoints. An ethical perspective follows the literature review and analyzes social engineering attacks and research from aphilosophical and professional viewpoint. An integrated summary promotes the idea of studying the topic from the three disciplines and attempts to explain the complexity of social engineering. Suggestions for future research are provided in an effort to mitigate social engineering risk and provide useable solutions for businesses today to protect themselves from this threat.

Why Teams Excel: Impact of Transformational Leadership (TL) And LeaderMember Exchange (LMX) on Team Performance (TP)

Thomas Tanner
Bloomsburg University of Pennsylvania

Dr. Margaret Walthall
University of Maryland Global Campus

Organizational culture can be a distinct reflection of leadership. As organizations work tobuild a culture of success and achievement, it is the responsibility of leaders to carry outthis vision by using both tactical and strategic thinking. Within this context of organizations, and specifically organizations consisting of teams, the performance of theorganization implies understanding the output of team performances. This becomes a shared responsibility between leadership and management, which includes human resource management (HRM). Their primary responsibility is performance management: the identification, measurement, and development of human performance in organizations (Rao, 2007).

Organizations expend time, energy, and money on performance management initiativesfor the purpose of influencing employee behavior for the benefit of the organization. Froma performance management perspective, managers provide feedback and coaching to

workers and offer recommendations for improving individual performance, which often includes identifying key behaviors to incorporate or avoid, and competencies to further develop. According to the Society for Human Resource Management (SHRM®), performance management involves setting expectations and goals at the individual level, to monitor the achievement of these goals, and to provide subsequent feedback.

Session 13: 11:00 am - Noon
Economics and Supply Chain Management
Chair:
David Jordan
Slippery University of Pennsylvania

Track & Trace: China's Central Bank Digital Currency
Daniel Folkinshteyn
Rowan University

Following the 2009 introduction and increasing popularity of Bitcoin, there has been a renewed interest in digitizing national currency systems, especially using the blockchain technology underlying the Bitcoin system. While there are efforts underway worldwide, one that is furthest along in its implementation is that of China, where a version of the digital yuan is being tested in areas covering a population of some hundreds of millions. The benefits of an entirely digital currency, in the form of convenience for the end user, as well as ease of management of the system by the central bank could be significant. However, there is also potential cause for concern in the form of excessive surveillance and government control of financial transactions. In this paper we explore the implications, costs, and benefits of a central bank digital currency, as well as the potentialapplications of blockchain technology in this area.

Session 14: 1:00 pm - 2:00 pm
Higher Education
Chair:
Cori Myers
Lock Haven University

Longhand versus Laptop Note Taking in an Introductory Accounting Course that Incorporates Interactive Skeleton Notes
Zeshawn Beg
Quinnipiac University

Kenneth Ryack
Quinnipiac University

Prior research suggests that students choose to take notes using laptops in college classes because it is faster and easier, but the technology serves as a distraction and negatively impacts academic performance. The literature also suggests that a more interactive class environment may mitigate the negative effect on performance. We conduct both a field study and experiment with managerial accounting students completing interactive skeleton notes during class sessions. Students choosing to use alaptop to complete the notes did so primarily because of its ease, while those taking longhand notes did so because they felt it enhanced their learning. We found no significant difference in average test scores and course grades between the two groups.However, further analysis revealed that use of a laptop had a strong negative effect for students in the lower half of academic performance as compared to no measurable effectfor students in the upper half.

Closing the (in the) Loop
Peter Huegler
Lock Haven University

Cori Myers
Lock Haven University

Business program's accreditation standards include documenting communications with stakeholders. Many communications with students, important stakeholders, occur using informal methods – like announcements in class, emails, etc. One option is to add to course syllabi handed out at the beginning of class. As the amount of information increases, this becomes an unwieldy solution. With the increased usage of Learning Management Systems (LMS), another option presents itself. A common course component can be created and shared among the program's faculty. Using the LMS, thecomponent can be maintained in one place and, at the beginning of the semester, copiedto all courses. A business program's common component for communicating various polices and assessment results is discussed.

A Comparative Study of Using AI Technology to Traditional Evaluative Coachingof Mock Interviews
Celia Lofink
University of Hartford

Advanced Intelligence (AI) tools are available to automate the mock interview process. The tool capability can pick up on a range of interview factors from movementsto words that can effect hiring potential. Level 1 of the interactive video stream of the mock interview does audio analysis including counting filler words, transcript of the interview, etc. Level 2 is video analysis to see if the student is expressive, engaged, dressed well, etc. The interviewer bot looks surprised when he talks, measures interviewees moods with precision from enthusiasm to anger. There is a level 3 option that provides feedback to the student after the video is reviewed by a professional expert.

This study asked the question – Would AI technology be at least equal to a human evaluator of the specific career preparation activities of mock interview practice on the factors of time and quality of real-time feedback. A comparison was done between the AImock interview and an in-person mock interview using scoring and subjective feedback of the rubric factors contained in the feedback form that matched both methods of interview.

Conclusions were drawn from the data analysis and will be shared in this presentation;

- Artificial intelligence - is it possible to replace a human being in adecision making process with the same evaluative result?
- Cognition – is it possible to get a computer to mimic the evaluativedecisions in the same manner as a human evaluator?
- Are there efficiencies of time, quantity and feedback (bias) to theexperience of mock interviewing without any loss of quality?

Session 15: 1:00 pm - 2:00 pm

Financial/Accounting

Chair:

Linda Hall
State University of New York-Fredonia

Mortgage Mathematics: Are Banks Ripping Off the Customer?

John Walker
Kutztown University of Pennsylvania

Ju Zhou
Kutztown University of Pennsylvania

Jon Kramer
Kutztown University of Pennsylvania

In this pedagogical research, we answer two questions raised during our teaching of mortgage mathematics. The first question is: If someone takes out a fixed-rate mortgageand pays it off after only a few years, isn't the bank "ripping off" the customer? The secondquestion is: When is the interest portion of a monthly mortgage payment exactly equal tothe principal portion? The first question is easier to answer because a mortgage is a financial contract with a known interest rate that the consumer agrees to pay. To providea fixed payment, the mortgage mathematics dictates that a greater percentage of interestis paid in the early years. To answer the second question requires increasing the numberof payments "N" to infinity to find the exact crossover point because the normally-discrete modeling of mortgage payments has no single payment

where there's a perfect 50/50split between the interest and principal payments.

100+ Years of Teaching Accounting = Suggestions for Change
Robert Derstine
West Chester University

James Emig
Villanova University

In our view some students have grown accustomed to memorizing what the textbook and Professors say (maybe even with a review session before exams to go over what will beon the exam), and then the students parrot it back on exam day -- often 'earning' a goodgrade in return -- with the students then suffering a 'mental enema'. In other words, thesestudents are satisfied and often rewarded grade-wise in becoming 'human parrots'. In today's world, with Google available to 'look everything up', we do not see a tremendousfuture for human parrots. Instead we are trying to get students to become adaptive problem solvers -- who will be better able to handle future opportunities and problems that do not even exist today.

Our two main objectives, are 1.) to simplify accounting presentations to help students understand – NOT to 'dummy down' accounting and 2.) to tailor our presentations for usein the 'live classroom', or the distance learning environment.

How do we do it? As illustrated in this article we: do not cover every page in the textbook; stress the 'Whys' not just the 'Hows'; state when and why we don't agree withthe textbook; and expose our students to some of the controversial items facing the accounting/business world in the rapidly Changing world.

Although we are accounting professors, and our examples therefore are couched in accounting, many of our approaches are equally applicable to other disciplines.

Ready or Not, It Will Come: Preparing Accountancy for the Next Disruption
Lisa Walters
State University of New York-Fredonia

Linda Hall
State University of New York-Fredonia

John D. Grigsby
Thomas Jefferson University

COVID-19 changed the world as we know it, necessitating unprecedented pervasive changes to the way we live, work, and educate. With the first case of COVID-19 identifiedin the United States in January of 2020 (Holshue et al, 2020), infections in the US continued to climb, culminating in substantial "life-as-we-know-it" shutdowns across the country by mid-March 2020. Such shutdowns caused massive job losses and economicdisruptions; however, these shutdowns were effective at halting the exponential spread of the virus (Achenbach and Meckler, 2020). Compounding the complexity of this situation for accountants is that the COVID-19 shutdown timeline coincided with the United States tax season, requiring quick process changes on behalf of accounting firms. Further complicating the accounting processes is the uncertain financial futures ofaccounting clients, who sought answers and assistance regarding available government support (US Department of Treasury) as they faced business failings, personal monetary devastation, and the anxiety that resulted from these events.

This study seeks to understand and present what the unintended consequences and nontraditional roles were experienced and assumed by accountants during the tax seasonof 2020, as compared and contrasted to earlier years. Such nontraditional roles include counselor, psychologist, virologist and IT specialist, among others. It further explores the concept of resiliency as it relates to accounting firms experiencing this black swan event. The data are analyzed and presented in terms of accounting firm size, function, and location.

Session 16: 1:00 pm - 2:00 pm
Remote Work and Learning
Chair:
Norman Sigmond
Kutztown University of Pennsylvania

Physical Location Preference for Different Types of IS/IT Task Work ofInformation Systems Professionals
Alex Citurs
Eastern Connecticut State University

This study looks at physical work task location preferences of IS/IT professionals alumniof a northeastern university. Analysis of the alumni survey respondents from (Summer 2020) examines their self-reported preference differences in working in different physicalorganizational settings, home locations, or other locations for common information systems professionals' work tasks. These include tasks such as: brainstorming, systems analysis and design, team/group meetings, complex analytical work, complex coding, and system review. The survey results indicate that there are significant differences in work location preferences based upon the nature of task. The study also examines respondents expected changes of amount of work time spent at different locations (organizational versus home locations) before, during and after the COVID19 pandemic as well as their top three ranked IS work tasks for performing in home settings and organizational settings.

WeChat But Do Students Listen Exploring the Use of Chinese Social Media Apps in Higher Education

Mark Lennon
California University of Pennsylvania

Nan Li
California University of Pennsylvania

With the rise in remote learning due to the COVID-19 global pandemic, the need to rapidlyfind viable technology solutions to connect educators and their students is critical.However, the effectiveness of many new technologies is hindered due to externality issues caused by lack of wide scale adoption and glitches inherent in any immature product. In contrast, WeChat - the highly successful Chinese social media app, is a stable,well established, feature rich software platform with an installed base of 1.2 Billion users.It holds great promise to serve as a viable solution for higher education. The goal of this exploratory study is to assess the potential of WeChat, by identifying key features and benefits, and examining actual implementations in educational environments.

Session 17: 1:00 pm - 2:00 pm

Sports Management/Analytics/Machine Learning

Chair:
Joshua Chicarelli
California University of Pennsylvania

Analysis of Machine Learning Techniques for Detecting Malicious PDF FilesUsing WEKA

Farida Keter
Bowie State University

Andrew Mangle
Bowie State University

The expansion of cloud and connected software and hardware has increased the attack surface of the modern enterprise. The growth in quantity and quality have led to greater possibilities of system vulnerabilities leading to exploits. One of the threat vectors attackers use is embedding malware to Portable Document Format (PDF) files. The popularity and flexibility of these file formats have made PDFs an ideal target for unawareusers. Malicious PDFs contain executable code used by attackers to steal company information or disrupt normal business operations. Adobe Acrobat and Reader users canview, create, manipulate, print, and manage files in PDFs shared hence increased risk.The National Technology Security Coalition report (2020) shows that 68% of data breaches occurred through email and 5% successful attacks through PDF files. In 2019,CVE recorded 17,306 software vulnerabilities on the Adobe Acrobat PDF reader. These

software vulnerabilities on Adobe Acrobat PDF may lead to unauthorized users controllingthe system, resulting in malicious programs, unauthorized access, and confidential data modification. The attacker may also delete data or create user accounts undetected. This study seeks to; identify threats, detect, classify, and create awareness of PDF malware on emails. This paper will present and compare different WEKA machine learning algorithms in malicious PDF detection and propose the best classifier from the analyzedalgorithms.

ESports in Higher Education A Distraction or No Problem

Tabea Ohle
Slippery Rock University of Pennsylvania

Jeananne Nicholls
Slippery Rock University of Pennsylvania

Kurt Schimmel
Slippery Rock University of Pennsylvania

This paper addresses the call for e-sport research by Funk et al (2018). E-sports has pushed itself into the elite sports realm with over $1 billion in revenue in 2019, over 250 million viewers worldwide (Pannekeet, 2019). For comparision the PGA had revenue of $1.9 billion in 2019.
In 2018 the International Olympic Committee entertained adding e- sports to the summer olympics. Colleges are also looking at e-sports as a growth area for competition. According to the National Association of Collegiate E-sports (NACE) there are over 170 esport programs in colleges in the US 5,000 players and 13 million in scholarships/aide. This research looks at a pilot survey of collegiate e-sports participants and fans at one university in the mid-atlantic region and examined whether there was a relationship between GPA and e-sports participation and viewership. The results of the suvey indicate that there is not a significant correlation between playing e- sports and GPA. There was also no significant correlation between e-sports viewing and GPA. There was a significant positive correlation between e-sports viewership and participation.

A Framework for the Qualitative Comparison of Sentiment API Service Providers

Jeremy Shafer
Temple University

This paper proposes a framework for the qualitative comparison of sentiment analysis API resources provided by the following visionary service providers: Amazon, IBM, Google and Microsoft. (Here, "visionary" is a designation assigned by Gartner, Inc.). APIis a set of functions and procedures used so applications can access the features or dataof an operating system, application, or other service. The intent of the investigator is to provide a general-purpose framework for the comparison of similar API resourcesprovided by multiple vendors.

The competing sentiment analysis processes have been applied to a novel body of unstructured data: the responses to the last three questions posed by the institutionally administered student feedback forms for a subset of classes taught by the investigator over the past five years.

This approach allows for discussion of the differences between the service providers, andhas the novel side-benefit of illustrating how student sentiment towards a specific coursein programming has changed over time.

Instructors of university level courses who seek to introduce API concepts and technologies into their classes, along with decision makers in MIS and related fields, willfind this topic to be both practical and thought-provoking.

Session 18: 2:15 pm - 3:15 pm
Finance and Computing
Chair:
Jane Booker
Pennsylvania State University

Information Complexity: Leveraging a Learning Network to Investigate GlobalBond Market Spillovers Under TCJA and COVID19
Nina Kajiji
University of Rhode Island

Gordon Dash
University of Rhode Island

Domenic Vonella
Refinitiv Financial

Steven Marcks
University of Rhode Island

Learning in feed-forward neural network theory is a complex information study that seeksto reconstruct a desired input-output function from contributed examples (i.e., functions). This research utilizes recent advances in radial basis function artificial neural network (RANN) learning to estimate regime dependent spillover elasticity metrics between the municipal bond returns of the US and the South African (SA) government 10-year bond. We use a unique trade-level database to examine municipal bond market volatilityacross SALT-impacted states and the South African government bond market. A two- regime learning simulation is tested. The first regime covers the Tax Cuts and Jobs Act of 2017 (i.e., TCJA). The second regime focuses on the time-frame defined by the global

recognition of the COVID-19 virus. Elasticity estimates from the first regime uncovered spillover caused by variation in the export of New Hampshire chickens to SA. Results from models of the second regime find a shift in spillover effects as well as a change in the elasticity of sovereign idiosyncratic market risk. The RANN information complexity algorithm deployed in this research proved capable of accounting for the shape and altered transmission of bond market volatility spillover between US states and SA.

Exploring Research Trends in Computing using the ACM ComputingClassification System
William Buzydlowski
No Affiliation Noted

Lillian Cassel
Villanova University

Exploring research trends in technology through the use of a controlled indexing vocabulary within a substantial dataset associated with a significant computing science corpus is of interest as it allows one to see the patterns of research within the computing sciences pursued and published over time. When the exploration is performedvia various visualizations, both static and dynamic, it allows for a more holistic analysis, particularly over protracted periods.

This paper analyzes the patterns of research that have been published within the Association for Computing Machinery's (ACM) digital library (DL), a significant computingscience corpus, from the years 1951 until 2017, a protracted period. The number of documents analyzed within that time frame was 448,249, representing a substantial dataset. The patterns of research are explored via the use of the ACM's controlled indexing vocabulary, the Computing Classification System (CCS). The number of CCS terms extracted from the documents was 1,075,197.

The analysis was performed using both static and dynamic visualization. The explorationsuggests three interesting trends that have occurred in the science over the time studied, as well as suggesting some topics that perhaps demand more focus. Of note, there has been a significant diminution in the mathematical aspects of the science, with a recent uptick in interest for the human-centered components of the field. A lack of research in security and privacy is also suggested.

Session 19: 2:15 pm - 3:15 pm
Entrepreneurship, Experiential Learning
Chair:
Joshua Chicarelli
California University of Pennsylvania

An Investigation into Factors that Affect Female Entrepreneurship in China andthe US: Case Studies and Policy Recommendations

Lillian Kamal
University of Hartford

This project is a part of a series that looks at the comparison of factors that influence female entrepreneurship, with particular focus on China and the United States. Through a series of case studies, an exploration of issues such as female access to credit, regulatory factors, the decision-making process for female entrepreneurs, and female entrepreneurship characteristics will be carried out. In addition, challenges that female entrepreneurs face are studied, and best practices among female entrepreneurs are identified. This particular presentation is a comparison of female entrepreneurs in Hartford, Connecticut and in Beijing. The entrepreneurs surveyed will range from those in very small one-person sole proprietors to medium-sized female-owned entrepreneurships with multiple employees. The survey questions are developed according to the methodology followed in the recent November 2018 Asia-Pacific Economic Cooperation Case Studies of 24 successful women entrepreneurs from 21 APEC nations (APEC, 2018), and the set-up of the case studies will also be similar, withquestions being divided into six sections: start-up methodology, business environment, success factors, challenges, advice for female entrepreneurs, and policy recommendations. Each case study will include a profile of the entrepreneur being studied. The overall study will be carried out in phases, with interviews of between 6-8 female entrepreneurs for each phase. Eventually, this study will extend into a series of case studies involving analyses of entrepreneurs in both the tertiary and quaternary sectors, including the retail industry, food services, the technology-based industry, the fashion industry, and the health and wellness industries. Cross-case-study analyses will be carried out to identify dominant themes and conclusions, and prepare overall policy recommendations. Ultimately, the study will conclude in the identification of best practices for female entrepreneurship in a recessionary and pandemic environment, as evidenced by the female entrepreneurs themselves. In addition, the study will identify initiatives that encourage and support female-owned businesses.

Theoretical Relevance for Working Mothers

Krista Troiani
Bloomsburg University of Pennsylvania

Women started entering the job market at the turn of the twentieth century as a demand arose during World War II. Women in the workforce had become a new ideal, and the challenges to balance work and home life began to present itself. The demographic shiftwas substantial, “between 1975 and 2009 when the labor force rate of mothers with children under age eighteen increased from 47.4 percent to 71.6 percent” (Bianchi, 2001,p.15). Although there has been an increase of women, there is still a societal belief on the role they should play and inequities that continue to plague the workforce. A workingmother often requires special accommodations during the time of her children’s youth, but then gives back to the organization due to gratification. “Over the course of a work

life, most individuals will experience a wide range of work and nonwork identity transitions" (Ladge, Clair, & Greenberg, 2012, p.1449). If a manager can effectively workwith an employee by implementing the right motivational tools during different periods oftheir life, it can lead to higher performance and development in the future. This paper will comprise of career development and motivational theories; along with contemporary drivers pertaining to working women relating to workforce education that are tied to current culture, policies, and training procedures within an organization.

The Value of Blended Learning and Course-Long Team Projects in Principles of Marketing
JC Blewitt
King's College

Introductory classes are the first, and sometimes the last, time to introduce an entire topicto a group of pupils. We, as instructors, must make that pivotal time count by providing an unforgettable experience with real-world applicability, creating learning objectives thathelp students understand the marketing discipline, and enhance their skills as future professionals. This article details an innovative approach to incorporating blended learning and a course-long team project in a Principles of Marketing course. Results fromtwo empirical studies support the effectiveness of this approach.

Session 20: 2:15 pm - 3:15 pm
Management
Chair:
Norman Sigmond
Kutztown University of Pennsylvania

Strategies to Prevent and Detect Occupational Fraud in Small Retail Businesses
Marquita Davis
Walden University

Business owners' lack of strategies to prevent and detect occupational fraud in small retail businesses in the United States could result in substantial financial losses or insolvency.Grounded in Cressey's fraud triangle, the purpose of this multiple case study was to explore internal control strategies 6 owners of small retail businesses in southeastern Pennsylvania used to prevent and detect occupational fraud. Face-to-face interviews, observations, and documentation are the data collection techniques I used in this study. Data were transcribed, coded, analyzed, and member checked to identify emergent themes. Six themes emerged from the thematic analysis: financial impact, transaction responsibility and monitoring, networking and business models, communication, separation of duties, and training. The results of this study indicated areas for action thatowners of small retail businesses could take to prevent and detect occupational fraud. Strategies business owners could implement to protect their businesses from occupational fraud include monitoring, employee identity documents to track employee

activity, separation of duties, and communication with employees. The implications of thisstudy for positive social change include the potential for social entrepreneurship becausesmall business owners create employment opportunities for members of the community,including high school students with the desire to run small retail businesses. Small business owners serve their communities by focusing on wealth distribution, including donations to local charities that foster economic stability with positive effects on society.

Not-for-Profit Fundraising Methods: Evidence from a Rural Setting
James Meersman
Juniata College

This paper compares not-for-profit fundraising methods in rural communities and seeks to understand how they differentiate from that of urban and sub-urban settings. Additionally, this study attempts to evaluate which methods of fundraising work best in communities with smaller populations. From a managerial accounting perspective, not- for-profit entities in rural communities are the most at risk for lacking the appropriate resources to fundraise. Furthermore, rural areas must rely on alternative strategies that do not rely on large scale campaigns often observed with urban, national, and international not-for-profits. Rural areas are regularly in need of the services that many not-for-profits can provide. However, the cost for non-local charities to provide these services in distanced areas is often too high, resulting in limited accessibility. Rural not- for-profits provide invaluable resources to the communities they serve, but fundraising limitations often thwart their ability to accommodate all of those in need. Taking a field study approach, this paper seeks to identify which methods of rural fundraising are mostefficient, and which strategies constitute best practice relative to not-for-profits in other settings.

Session 21: 3:30 pm - 4:00 pm
Best Paper Presentation
Chair
Loreen Powell
Bloomsburg University of Pennsylvania
President and Conference Director, NABET

Stock Price Reactions to Announcements of Mergers and Acquisitions
Sunando Sengupta
Bowie State University

Tibebe Assefa
Bowie State University

Satina Williams
Bowie State University

Noel Knott
Bowie State University

Joekorvaya Sallia
Bowie State University

Bobby Stanley
Bowie State University

This paper investigates whether abnormal returns exist around the announcements for Mergers and Acquisitions (M&A) that occurred from 2011 to 2019. We analyze the impactof the M&A announcements on the stock price of acquiring and acquired firms. Earlier research has shown that M&A events related to stock-generated investor reactions tendto affect the stock price of the companies involved in the M&A transactions, usually on avery short basis. When a company acquires another company, the stock price of the target company typically will rise, and the stock price of the acquiring company declines,in the short term. It is predicted, in prior research, that the target company's stock will rise because the acquiring company pays a premium for the acquisition. Amazon, Facebook,General Electric, Google and Cisco are examples of well-known companies that have participated in M&As. Our sample consists of 33 pairs of firms that announced M&As overa nine-years period from 2011-2019. We first identify the announcement or event dates and then utilize Event-Study methodology Eventus, from the Wharton Research Database (WRDS), to test for the presence of abnormal returns around the event dates.Our results show significant positive 11. 52 percent Cumulative Abnormal Returns (CAR)for the acquired firms one day before the announcement date up to the announcement date for acquired firms. On the contrary, the results show significant negative CAR of 3.72 percent for the acquiring firms from 3 days until 30 days after the announcement date, which could be due to the premium paid to acquire.

Friday, October 23

Session 22: 8:00 am - 8:30 am

Welcome
Loreen Powell
Bloomsburg University of Pennsylvania
President and Conference Director, NABET

NABET Conference Proceedings and JBET Information
Norman Sigmond
Kutztown University of Pennsylvania
Chairman, NABET Board and Co-Editor of Conference Proceedings and JBET

Jerry D. Belloit
Clarion University of Pennsylvania (Retired)
Vice-Chairman, NABET Board and Co-Editor of Conference Proceedings and JBET

Each year NABET offers conference presenters the opportunity to be published in the Peer-Reviewed Conference Proceedings. Separately, NABET also publishes a Cabell's listed journal, the Journal of Business, Economics and Technology (JBET). Often, our constituents get these two publications confused. The two publications serve different purposes. The Conference Proceedings offer each conference presenter an opportunity to have his/her paper published in a peer-reviewed publication. The author's paper will go through a review process. But, it will not be subject to the double-blind review and editorial processes of a referred journal. Further, each paper that is submitted to the Proceedings will be published. On the other hand, the Journal of Business, Economics and Technology which uses a double-blind review process is considerably more thoroughthan the review process of the Proceedings. At JBET, only 35% of the submissions will be published. This presentation will cover these distinctions and several other aspects ofeach publication. It will also offer advice to would-be authors on how to enhance their prospects of achieving publication.

Session 23: 8:30 am - 9:30 am
Economics
Chair:
Jane Booker
Pennsylvania State University

Challenges of Financially Managing a Success School District
Theresa Phipps
Slippery Rock University of Pennsylvania

In 2020, an inner-ring suburb of Pittsburgh, Ross Township, made the Money's Best Places to Live in America, ranking 48th of the top 50. That recognition is in part due to the success of the North Hills School District, to which Ross Township belongs. But thatsuccess was not achieved overnight, and its foundation may be shakier than it seems. This article, through a twenty-year case study of the North Hills School District, examines the challenges of financially managing a successful public-school district facingthe common problem of unpredictable and substantial fluctuations in annual student population. This chronicle has elements of a success story, but it is too soon to evaluatethe full effect of the virtually-irreversible decisions that the school district made in this period – the selling of school buildings and the parcels of land on which they sit. From this study, this paper posits that such a decision, along with the resulting increases in property tax rates, is not a prudent approach to the financial administrative of an otherwise healthy and high-achieving school district. This is especially so in light of the alternativesfor managing unpredictable fluctuations in student population.

Market Disequilibrium and its Application to the Gas Sector

Yuli Radev
University of Mining and Geology

Reneta Barneva
State University of New York-Fredonia

After a careful reading of the classical concepts of market equilibrium and the process of negotiation, as well as after a of thorough study of the contemporary theories of dynamic equilibrium of markets and contracts among agents, in this work we propose models of static and dynamic disequilibrium. The theory of disequilibrium presents the trade exchange as a balance between the sequential spot markets and the long-term contractsand is an alternative of the dominating paradigm of the market equilibrium. It provides powerful tools for implementing large and complex empirical investigations. In particular,it is useful for solving the problems, accompanying the natural gas trade, in which spot markets and long-term contracts coexist.

We describe the models and then we comment on their application to the gas sector.

COVID-19 Impact on Retailing

Denise Ogden
Pennsylvania State University - Lehigh Valley Campus

James Ogden
Kutztown University of Pennsylvania

Timothy Schauer
University of Lynchburg

In early 2019, retailers had reason to be optimistic. Unemployment was low and while many retailers closed branches, overall, retailing rose. The hospitality and travel industries were at their highest revenue levels in more than 16 years and consumer spending was at a high. Traditional retail formats were no longer working as omnichannelretailing took hold. Very few could have predicted that retail employees would become essential workers as a pandemic hit the world. The retailing industry took a major hit andexperts are unsure about a total recovery. In this paper we examine the impact of COVID-19 on retail environments and what the future of retailing may hold.

Session 24: 8:30 am - 9:30 am

Strategy
Chair:
Cori Myers
Lock Haven University

Creating Value Artificially: Resourcing AI in Organizational Strategy
Joseph Rosendale
Indiana University of Pennsylvania

Daniel Dieter
Indiana University of Pennsylvania

The future of business is constantly changing perhaps more quickly now than at any pointin the past. New business strategies, modeling, globalization, and regulations, among many others, all play a critical role in organizational advancement and executive decisionmaking, while the need for firms to constantly innovate remains irrefutable. After a brief overview of artificial intelligence (AI), this presentation discusses the potential for AI to serve as a valuable firm resource and driver of value creation for organizations. Using the resource-based view, the presenters explore factors associated with AI as pertains to the technology's value, rarity, imitability, and substitutability. Noted benefits of incorporating AI include convenience for consumers, better firm responsiveness, and increased accuracy of information. Integration considerations suggest aligning AI with core competencies of the organization, increasing training and exposure for managers and employees, and investing in appropriate technology to maximize the impact of AI.

Investigating the Role of Alignment as a Foundational Building Block forWillingness to Adopt Learning Analytics by Higher Education Faculty
Michael Knupp
Husson University

Higher education institutions (HEI) are beginning to invest heavily in learning analytics asa compliment to their existing suite of technologies used to enhance the pedagogical practices of instructors. A culture of learning analytics within HEI is emerging but there isnot consensus on the value and effectiveness of the tools and practices that make up theculture. The emerging culture is exerting change forces on key stakeholders (namely thefaculty member themselves) and these forces are not clearly understood. A lack of understanding of the change forces may result in unintended consequences for both thefaculty member and the institution at large. Learning analytics is in its infancy and the adoption and integration by higher education faculty represents a new and emerging phenomenon that is worthy of study and understanding. With promises of reduced studentdropout rates, improved student outcomes, better course pedagogy and backed by pressures of assessment and accountability, learning analytics is being trumpeted as thenext best solution to our educational woes. However, despite these promises and despite

the general belief that learning analytics may have true value, instructors have been slow,if not resistant, in learning analytics adoption. And while research on learning analytics design abounds, usage and adoption literature that focuses on the faculty member's perspective is scant. More research is needed to understand factors that either threatenor enable a higher education faculty member's willingness to adopt learning analytics. The following research proposal seeks to examine the influence of professional identity alignment, pedagogical alignment, learning analytics alignment and organizational alignment on a higher education faculty member's willingness to adopt learning analytics.

Survival Strategies of Japanese Amusement Arcades: A Case Study
Hideki Takei
Central Washington University

In Japan, survival games of amusement arcades called Game-centers have begun. Large game-centers owned by major video game producers have transformed into family-oriented amusement parks with different types of games and attractions. However, independent game-centers with limited financial capacity have hada difficult time finding the best possible ways to survive.

One of the best possible survival strategies is a niche strategy in which the game-centerswill focus on a specific segment of game players to maximize operational efficiency and profits. Such segments could be senior players, hardcore players, families, shoppers at shopping malls, young couples, and kids.
On the other hand, many independent game-centers have focused on a retro video gameplayer segment to survive. This strategic move has been so popular as they tend to haveoutdated video game machines due to limited financial capacities to update. So, they canfocus on the niche without spending so much money. Even if they must put more retro video game machines, they may be able to do so as outdated game machines are very cheap.

In this paper, we studied the survival strategies of game-centers, which focused on the retro video game player segment to develop a general model of the niche strategy. Then,we interviewed executives and core employees of one of the most successful game- centers, who focused on the segment to refine the general model.

Session 25: 8:30 am - 9:30 am
Accounting
Chair:
Lisa Walters
State University of New York-Fredonia

Hard to Cook the Books when Everyone is in the Kitchen: An Exploration of TripleEntry Accounting & Blockchain

Joshua Chicarelli
California University of Pennsylvania

Mark Lennon
California University of Pennsylvania

The purpose of accounting is to capture and convey information about a business to those individuals who have an interest in the business. First developed for renaissance merchant bankers, a double-entry accounting system enables business owners to maintain detailed records of what they own and how they came to own it. While historicallyhighly effective, in our modern, more complex economy, in which owners and day-to-dayoperators are often separate entities, double entry accounting comes up short. Asymmetries of information and agency problems are prevalent which lead to financial fraud. Proposed over thirty years ago, triple-entry accounting seeks to rectify these issues, but was never widely adopted due to concerns about cost and complexity. With the development of blockchain technology, a crypto-graphically secure, immutable ledger, open source software solution best known for crypto-currency applications, triple-entry accounting's time is finally here. By describing both the technology, and examining actual firm implementations, this paper explores the costs and benefits of implementing a blockchain driven, triple-entry accounting system.

Are the Quantity Theory and Money OTM Still Relevant?

Conway Lackman
International Consulting Group

William Carlson
Duquesne University

In the St.,St. Louis Federal Reserve Review of Nov, 1968, Anderson and Jordan presented strong evidence suporting QTM preseinted strong evidence suppointing QTMand Paul Volcker used monetary policy to defeat the Great INflaiton in 1982.

But, work by Xi Wang (Washinton U(and Robert Lucas (U o Chicago) found that QTM broke down in the mid 80's which rendered the St. Louis Fed model useless.

Before discarding QTM and monetary policy, we consider the following points:

Our statistically signifacnt regression models for 1985-2000 showing moneyaffected the economy in that period. We are working on 2000-2020.

Following Xi and Lucas-Nicolini, we propose a new money definition (addingcredit card and home equity) for better results.

Fed induced recessions prior to 1984 hav different relations than post '84 recessions caused by exopenous factors which impacts the regression models.

The Fed prefers the Federal Funds rate to conduct monetary policy rather thanthe money stock. We compare the two methods.

A New Approach to Archival Research to Understand the Influence of RobertSprouse

Keegan Maguigan
University of Maryland, College Park

Peter Oehlers
West Chester University of Pennsylvania

Richard Barndt
West Chester University of Pennsylvania

Robert Sprouse was a scholar, President of the American Accounting Association, and Financial Accounting Standards Board vice-chairman. Sprouse bridged the gap betweenacademia and practice. While others have acknowledged his influence in the field of accounting (Previts & Merino, 1998; Zeff 1999; Swieringa, 2011), his connections with colleagues and contributions have not been studied in depth. This paper uses a new approach to archival research to demonstrate how Sprouse's network and literature contributions can explain his influence in the field of accounting. By using analytical techniques, data visualization provides a greater understanding of Sprouse's career.

Among the techniques that can be used are network analysis and literature mapping. Network analysis is becoming increasing important in digital history research. The resultsof a network study can be used as an illustration and a tool for understanding (Graham et. al, 2016). Additionally, a literature map is a visual summary to understand how a qualitative study adds to, extends, or replicates existing research (Creswell, 2016).

Expected results indicate that in addition to Sprouse's distinct connections and contributions, he was an integral part of the academic study and practice of accounting, including research and application of accounting concepts. For example, Sprouse's colleagues played an important role in the development of his career which included literature that discussed fundamental accounting concepts as well as analyzed their practical application.

Session 26: 8:30 am - 9:30 am

Economic and Finance

Chair:

David Jordan

Slippery Rock University of Pennsylvania

Detecting Commonalities in Asset Management Budget Justifications

David Lanter

Temple University

This paper explains how an ontology-based object-oriented processing application and database system can be implemented to process asset management work order budgetjustifications to detect and analyze patterns of commonality of their business cases. Central to this effort is incremental creation of an asset management budget justification ontology, followed by implementation as a global object-oriented data modelthat supports comparative analysis of budget justifications for individual asset management work orders. Focused on the Operations & Maintenance (O&M) business function, this research suggests a way to achieve a unified standard language and suite of intelligent tools for helping businesses analyze and understand justifications for asset management work order investments within and among an organization's business functions.

Impact of Gender on Financial Goal Setting and Planning

Fan Liu

Shippensburg University of Pennsylvania

Both women and men desire to achieve their financial security. Financial planning as a long-term methods allows us to manage certain financial aspects of our lives. However, women and men tend to have different financial behavior that may play key role in the financial planning. In this paper, we analyze the survey data collected by the Consumer Financial Protection Bureau to examine the gender effect on goal setting in the financial planning. We observe that women overall tend to be more likely to set financial goals or create plans to secure the quality of life even though they are less financially knowledgeable and more economically disadvantaged in the society. In particular, we identify that such gender difference is more noteworthy among working-age individuals but not among retirees. Further, we also explore how gender influences financial goal setting and planning decisions within different ethnic groups.

Forecasting Gross State Product: A View from North Dakota

Kareem Tannous

Cabrini University

Forecasting gross state product required an analysis of economic indicators that affectedstate activities in North Dakota. In this study, I conducted a multiple regression analysis that analyzed the relationship between the rate of change of total employees in five sectors of the North Dakota economy. Using time-series employment data between 1997and 2007, I forecasted the rate of change in North Dakota gross state product. Calculatingthe rate of change of the variables and data from the manufacturing, energy, transportation, agriculture, and life services industries, I was able to forecast with statistical significance, the rate of change in North Dakota gross state product with a large R2 = .9536.

Session 27: 9:45 am - 10:45 am

Government and Economics

Chair:

Jane Booker

Pennsylvania State University

Is China's Stock Market Affected by Government Policy?

Zhen Ma

Misericordia University

This study investigates whether China's stock market is affected by government policy. The policy-driven feature of China's stock market induces a debatable argument that political interference should be responsible for the sharp fluctuations of the stock markets because of discretionary changes in government policies. Therefore, the investigation of the relationship between the risk arisen from government policy and the volatility in the stock markets is of particular importance to both policy makers and investors.

There are two parts to this research. Part one develops a policy-related volatility index based on the frequency of news articles published in the 5 selected sample official newspapers to measure the volatility and/or uncertainty in China's stock markets that arerelated to policy events such as government intervention, official comments, regulatory activities and market expectations or market rumors. Part two empirically identifies the impact of government policy on the volatility of the stock markets using regression analyses with the policy-related volatility index being the key explanatory variable. Results suggest that government policy has significant effects on the volatility of China's stock market. This is true for the entire sample period, as well as for the sub-samples of both bull markets and bear markets.

This presentation focuses on the empirical analyses of the effects of government policy on China's stock market volatility.

Effects of PAC and Lobbying contributions on Corporate Tax Avoidance

Jorge Romero
Towson University

This study explores the link between PAC contributions and lobbying contributions and their effects on corporate tax avoidance. Specifically, this study looks at publicly traded firms over a long period that has incurred PAC and lobbying contributions. Documentationshows that the tax code may favor individual firms, so the research question explored inthis study is: Do firms that incurred in these types of contributions paid fewer taxes than they would have otherwise? It is not fully understood the relationship between PAC and lobbying contributions. There is a complicated relationship between them where each ofthem may have critical implications in favorable regulations, in seeking influence, and subsidies from the government.

Essential Factors That Influence Corporations to Outsource to Sub-SaharanAfrica: A Follow-Up Case Analysis of MBE Corporation

Jet Mboga
Bloomsburg University of Pennsylvania

Outsourcing is a powerful way for organizations to enhance service, save money, and focus on core competencies while helping develop a cost-effective global chain that meets the increasing needs of customers regarding cost, flexibility, and responsiveness. Companies initiating outsourcing collaborations must decide not only between in sourcing versus outsourcing and near shoring versus far shoring; leaders must consider the scope of global projects. The purpose of this qualitative research wasto conduct a follow-up with a case study that was conducted on a consumer electronics service company located in Northern USA under the pseudonym company name MeganBay Enterprise (MBE) corporation. In this case analysis the decision makers wanted to track the effects if any of the initial case analysis and weigh out MBE's stand on the 2013case analysis that had outlined benefits of opting to outsource to Sub-Saharan Africa (seeAppendix A) instead of using in-house workforce to perform their core competency of customer service tasks. The participant sample was consistent with the 2013 case analysis and contained a purposeful sample of 20 MBE employees that had the same range of 1 to 15 years of working experience. The same 2013 questionnaire was appliedwhen interviewing the managers at MBE Corporation. The present findings from the 2015case analysis were undeviating from the first study and confirmed the following themes

(a) gaining benefits such as opportunities to improve performance, (b) increase efficiency,
(c) lower costs, and (d) increasing focus on core competencies. The proposed results could contribute to the organizational leaders understanding of the advantages of outsourcing by corporations that are relentless in using in-house workforce and cynical about using experienced outsourcing workforce for their services.

Session 28: 9:45 am - 10:45 am

Pedagogy
Chair:
Cori Myers
Lock Haven University

Undergraduate Business Student Preferences in Emergency Remote TeachingDuring the Covid19 Pandemic
Matt Shatzkin
York College of Pennsylvania

Emergency Remote Teaching, the act of teaching at a distance during a crisis, is a less studied field than traditional remote or online learning. However, during the Coronavirus (COVID-19) outbreak in March 2020, many colleges and universities physically closed and implemented Emergency Remote Teaching to continue the spring semester. As thepractice of Emergency Remote Teaching will continue in varying degrees throughout theCOVID-19 pandemic, it is valuable to understand the preferences and needs of students in order to deliver effective education. With this in mind, undergraduate students at Graham School of Business, York College of Pennsylvania were surveyed on their preference of Emergency Remote Teaching delivery method and frequency of virtual sessions. For the combination of flexibility and support provided, the preponderance of students preferred hybrid methods of delivery, which combined traditional online methodsof asynchronous and synchronous methods. For similar reasons, the students preferred a moderate amount of virtual sessions, as opposed to virtual sessions for all classes, or none at all. These preferences were found to be both statistically significant and unaffected by the independent variables of working or the volume of classes taken. At the same time, these preferences were found to be somewhat disconnected with the methods of delivery provided by the respective instructors. Overall, this study builds uponprevious research in the field of Emergency Remote Teaching which reflects the student preference for a combination of flexibility and support. Furthermore, it provides relevant insight into the ongoing practice of Emergency Remote Teaching and provides areas for future study that may contribute to improving the efficacy of this necessary practice as the COVID-19 pandemic continues.

The Relationship Between Social Networking By Students And The EnhancementOf Learning Of Business And Management Students In Institutions Of Higher Education Of The Us: A Mixed Method Study
Abdulaziz Bahha
Northern Kentucky University

The purpose of this mixed-method study is to examine the relationship between social networking by students and the enhancement of learning of business and management students in institutions of higher education of the US. The researcher conducted a literature review while proposing this topic for the dissertation. During the literature review,it is found that there was a significant research gap in the literature regarding the impactof social networks on the business management skills of students despite the fact that educational institutes in the US were rapidly implementing those networks. A large number of educational institutes have implemented social networks. Still, not much research has been conducted regarding the impact of these networks on the professional development and management skills of business students. Therefore, after identifying this research gap, the researcher is proposing to fill this research gap by conducting a primary study analyzing the impact of social networks on the management skills of students.

Alexa What's my GPA? A Taxonomy of Amazon Echo Educational Skills
Adnan Chawdhry
California University of Pennsylvania

Edmund Matecki
California University of Pennsylvania

Christian Ola
California University of Pennsylvania

Alex Dalton
California University of Pennsylvania

The concurrent proliferation of voice-enabled consumer devices and the isolation of students at home due to the COVID-19 pandemic, presents a unique research opportunityto explore how these devices - such as market leader Amazon Echo and its Alexa Skills ecosystem - can enhance learning outcomes. While existing research centers around technical and privacy issues about these devices, there is scant consideration foreducational opportunities, and no systematic evaluation of Alexa educational skills (aka apps). This preliminary study seeks to fill this gap in the literature by surveying popular Alexa Echo Educational Skills, and then evaluating them in terms of Bloom's taxonomy. The objective is to identify which Alexa Skills hold the greatest promise for promoting cognitive abilities and critical thinking among students.

Session 29: 9:45 am - 10:45 am
Marketing, Entrepreneurship
Chair:
Linda Hall
State University of New York-Fredonia

Doing Good, Looking Good
Karen Robinson
York College of Pennsylvania

The goal of this proposal is to provoke a discussion on whether doing good can financiallybenefit the fashion industry. This idea came from merging two important influences in mylife: fashion and sustainability. This researcher has discerned that sustainability isessential to the survival of the fashion industry. The purpose of this research is to test thevalidity of that theory by examining current literature to explore the bases for this theory and explore what the industry is doing to prolong its existence, protect the environment and improve financial performance. The use of outcomes from this research presentationmay provide aid to managers, researchers, consumers, academics and the industry.

Comparing Entrepreneurial Ecosystems - Technology Entrepreneurs and Social Entrepreneurs
Don Goeltz
Holy Family University

The term "entrepreneurial ecosystem" was first used in the mid-1980s to describe the overall supportive environment for venture creation and success, with Silicon Valley as the prototypical example. It has been generally accepted that a robust entrepreneurial ecosystem is associated with both venture creation and venture success, although the research results are inconclusive and mixed. In addition, the definition and usage of the term has become less crisp as new categories have emerged, such as intrapreneurs andsocial entrepreneurs, as new funding sources are created, such as micro-lending and crowd-funding, and as digitization has decreased the necessity to be physically located in a geographic location.

This paper updates and expands the definition of entrepreneurial ecosystems andcompares the updated term to two different types of entrepreneurial ecosystems, traditional technology-based and social entrepreneurship. Entrepreneurial ecosystems for technology ventures and social ventures in the Philadelphia are used to illustrate the differences and to recommend strengthening both ecosystems.

Session 30: 9:45 am - 10:45 am
Healthcare Concerns/ Marketing/Pedagogy
Chair:
John D. Grigsby
Thomas Jefferson University

Comparison of Health Care Power of Attorney Approaches

John Cameron
Pennsylvania State University

The health care power of attorney approach affords a competent adult the ability to plan for future health care decisions. If the person is no longer capable of making decisions, the power of attorney authorizes the agent to make health care decisions on behalf of theprincipal. The power of attorney for health care may also include individual health care instructions. The enforcement of fundamental obligations between the physician and theagent will need to be considered in light of state health care power of attorney statutes. Toprovide health care services under the direction of the power of attorney, the healthcare professional is still required to comply with standards of appropriate practice. If the patient losses decision making capacity and is no longer able to participate actively, the health care power of attorney becomes effective and the agent assumes responsibility formaking decisions for the care of the patient. The healthcare professional is required to follow statutory provisions prior to prescribing treatment for the patient. The interpretation of the statutory provisions by physicians, health care facilities, insurers andfamily may present uncertainty because of a multitude of scenarios, including treatment options, safeguards, prognosis, medical judgment, and impairment of dignity. Prior research to examine the variances in the provisions associated with health care power ofattorney legislation within the United States has been limited. To address this gap in the literature, this paper will examine health care power of attorney legislative trends includingthe appointment, eligibility, access to health information, disclosure requirements, medical limitations, range of life-sustaining interventions and authority of agents.

A Systemic Model of the Latest Tactics in Marketing

Philip Van Berten
Stevenson University

This qualitative research claims to clarify the respective capabilities, as well as appropriate opportunities brought to digital marketing by social network marketing, big data, inbound marketing, and design thinking. A systemic modeling approach of the general marketing practice describes the relationship and interactions of each of those digital marketing tools. The result is a decision-making conceptual tool designed to help marketers in their practice.

Effectiveness of Online Course Engagement Methods to Improve LearningOutcomes

David Jordan
Slippery Rock University of Pennsylvania

Sunita Mondal
Slippery Rock University of Pennsylvania

Natalie Dick
Slippery Rock University of Pennsylvania

According to the US Department of Education, about 20% of post-secondary undergraduate students were taking at least one distance education course in 2008 (Radford & Weko, 2011). By the fall of 2018, the percentage of undergraduate studentsenrolled in online courses had increased to 35% (US Department of Education, 2018). Yet, as the trend toward distance education enrollment increases, academic leaders remain skeptical of its efficacy. According to a study conducted through the Online Learning Consortium, only 29.1% of academic leaders reported that their faculty accepted the "value and legitimacy of online education" (Online Learning Consortium, 2016). Thereis a need for more evidence that online education results in adequate student learning outcomes. In addition, more evidence is needed to demonstrate which methods are effective in engaging students in the online realm. This study investigates factors of online engagement and how they may lead to improved learning outcomes for online students.This is accomplished through the examination of an online course engagement rubric implementing an Ordinary Least Squares (OLS) regression analysis. The variables in therubric demonstrate ways in which online course instructors can encourage engagement and improve student performance outcomes in online pedagogies.

Session 31: 11:00 - Noon
Ethics
Chair:
Jane Booker
Pennsylvania State University

The Corporate Performance After Unethical Behavior: A Review of ContemporaryEthics Scandals

Y. Bora Senyigit
King's College

The corporate performance has been affected by various ethical factors such as an ethical leadership, ethical culture, and a shared commitment of the management and employees to the core values of the corporation. The collapse of Enron Corporation in 2001 or the Volkswagen emission scandal in 2015 show that an unethical behavior or a lack of ethics can do significant harm to a corporation. However, the outcome of recent corporate ethics scandals is different from that of the accounting scandals of the early 2000's. For example, Volkswagen has recovered from the damage caused by the emission scandal, but Enron, WorldCom, and others declared bankruptcy after their unethical accounting practices. The purpose of this study is to examine contemporary corporate ethics scandals such as Toshiba in Japan and Volkswagen in Germany and analyze how these scandals have affected the corporate performance of Toshiba and

Volkswagen. In addition, this study also goes further by exploring the recovery processof these respected corporations.

How to Plan and Execute An Interdisciplinary Business Ethics Case Competition
Alexa Laskowski
West Chester University of Pennsylvania

Richard Barndt
West Chester University of Pennsylvania

Peter Oehlers
West Chester University of Pennsylvania

A solid grounding in the fundamentals of ethical decision making in the professional worldis an essential part of a business education. The ability to make decisions that balance ethical and financial considerations often requires critical thinking, in depth analysis, problem solving, teamwork, and communication skills. While the fundamentals of these skills can be presented in core coursework, the complexity often faced in making ethical business decisions can be brought to life through an interdisciplinary ethics case competition. This type of interactive learning experience transcends and elevates the typical classroom experience by giving students the opportunity to interact with peers andprofessionals, learn from each other, and develop a more diverse educational background. This paper explores the benefits of using interactive case competitions as a learning and professional tool. Additionally, it chronicles the process followed by leadersof a Beta Alpha Psi chapter in organizing and executing a successful interdisciplinary business ethics case completion. The paper describes how approximately fifteen teamsof six students each made up of majors from multiple business disciplines, mathematics,and computer science came together for a one-day competition judged by a panel of sponsor firm representatives. This paper offers a successful model for schools, student organizations, and sponsoring organizations to follow in planning and executing an interdisciplinary business ethics case competition and is supported by anecdotal evidencefrom participant and sponsor post–event debriefings.

Examining Online Cheating in Higher Education Using Traditional ClassroomCheating as a Guide
Kerry Adzima
Pennsylvania State University-Erie

Academic dishonesty in higher education is a perverse problem affecting institutions of learning in many countries across the globe. More alarmingly, numerous studies have pointed to increasing rates of cheating and plagiarism over the past few decades offeringa wide array of explanations and theories for this trend. A relatively new feature of both higher education and the discussion of academic dishonesty involves the growing marketfor online education. Within the last decade, online education has become a permanent

fixture increasing its reach in education markets throughout the world. The trend of online education is seen as bringing with it a new set of opportunities and challenges related toacademic dishonesty. With high rates of cheating already a well-documented problem inthe traditional (face-to-face) learning environment, it is important to analyze how online education factors into this scenario. The goal of this paper is to provide the reader witha critical analysis of the current literature on academic dishonesty in online education andto propose areas for future research where gaps in the literature exist.

Session 32: 11:00 - Noon
Cybersecurity and Remote Learning
Chair:
Cori Myers
Lock Haven University

Government Cybersecurity: The State of the Union
Carolyn LaMacchia
Bloomsburg University of Pennsylvania

Edward Keller
Bloomsburg University of Pennsylvania

Businesses often collect and store sensitive personal information in order to perform necessary functions like satisfying customer orders. Governmental organizations also collect and store sensitive personal information to perform necessary functions like collecting taxes, renewing licenses, and providing social security benefits. Cybersecuritybreach events affect businesses of all sizes and government office alike. The liability lawsfor business and government differs. The law incentivizes businesses to implement a comprehensive cybersecurity platform. However, the common law doctrine known as sovereign immunity and the Federal Tort Claims Act can influence a government office tonot invest limited budgetary dollars for adequate cybersecurity protection. This article reports on the state of a sampling of government organization's cybersecurity programs.

Assessing the Organizational and Personal impacts of Data Breaches
Adnan Chawdhry
California University of Pennsylvania

Mattie Slonekar
California University of Pennsylvania

Today's evolving technological environment relies heavily on interconnected systems over using the world wide web that collect, store, and process metadata about individualsand their activity within each respective information system. The amount of data collected doubles each year allowing organizations to analyze it and develop effective strategies

that can improve customer experience and drive increased revenue. Other organizations store these data points as public record including criminal record searches,property assessments and sales, and other records that available to the general public. While the collection of these data points are pivotal to organization for various reasons, the data itself can contain highly personal information that if breached could result in negative impacts to these organizations and the individuals they represent. More importantly, what happens when this information is inaccurate and publicly available through the internet. This paper will study the various sources information systems that collect our personal information, the impacts to us for data breaches, and the effect of disseminating inaccurate information publicly. The assessment will conclude with recommendations on how to better protect ourselves fromdata breaches and dissemination of inaccurate information.

Online Learning Tools Effectiveness of Podcasts in a Remote Environment

Elizabeth O'Hara
Assumption University

Keeping students engaged in the classroom is not a new challenge for higher educationfaculty. Lectures, case studies, and slide presentations are often the primary mode for in- person instruction. The increase of online and remote teaching has caused faculty to rethink pedagogical practices and methods of delivery.

To explore effective online learning techniques, a study is being conducted at a small, liberal arts Catholic college in Massachusetts. The study is focused on the effectiveness of various technology, specifically Podcasts, to teach, engage and motivate students to learn in a challenging environment.

Data are being collected from students who have used podcasts as part of their onlinelearning curriculum.

Problem Statement: Are students more or less engaged in an all remote online teaching environment? Do podcasts create a stimulating and interesting method of learning and mode of delivery?

Lecture recordings are the most popular form of podcasts but their use as supplementaryor additional materials in the form of post-lecture summaries, interviews, discussions, andreminders are also found.

The podcasts used in this study are not recorded lectures. Instead, the podcasts are professionally produced, audio only podcasts where executives in various sport related fields were interviewed. A survey based on student self-assessment of the effectivenessof the podcasts, the relativity of the content is being conducted.

Session 33: 11:00 - Noon
Technology Pedagogy
Chair:
Joshua Chicarelli
California University of Pennsylvania

Other People's Profiles: Using LinkedIn as a Teaching Tool
Bernice Marie Purcell
Holy Family University

Faculty encourage students to create LinkedIn profiles and to use LinkedIn for job searches, but often realize that as soon as the profile is created, many students abandonLinkedIn. A new approach is to incorporate a series of assignments in which students not only create a profile but then use LinkedIn for a further assignment. The students were required to develop a search strategy of their own, explain the search strategy, findthree people with positions the students aspire to, and analyze the profiles to explain whythese people are suited for their positions.

Impacts of Project Based 3D Printing Modules on Student Technology Efficacy
Laura Gurney
Husson University

Kimberly Davis
Husson University

This study examines the impact of project-based 3D printing educational modules on technology self-efficacy in private university students. Utilizing free, online software packages and university owned 3D printers, along with specific client-based project requirements, students showed an increase in technology confidence levels, reported increased consideration of future technology implementation, specifically 3D printing, in future employment, and increased appreciation of 3D printing capabilities. Pre- and post-surveys of participating students in the learning modules showed increases in self- reported confidence in technology capabilities and perceived usefulness of 3D printing within their career field. Students surveyed in the same major, without exposure to the project-based technology module expressed desire for similar 3D printing unit integration.

Using Excel as a Structured Learning Environment
Eric Blazer
Millersville University of Pennsylvania

Excel is the tool of choice in the business world for data analysis and financial modeling.In higher education Excel can be used to develop a rich, real time learning environment for students. By using conditional formatting, data validation fields, embedded comments,videos, and other Excel features faculty can create rich interactive worksheets that provide students just-in-time learning and real-time feedback. This paper describes the basic techniques for creating dynamic self-correcting worksheets to illustrate a variety of concepts in finance and accounting with applications to other fields. It describes how to use Excel to develop a rich visual hands on learning environment.

Session 34: 11:00 – Noon
Organizational Dynamics
Chair:
Norman Sigmond
Kutztown University of Pennsylvania

Social Distancing of Virtual Work
Annette Rogers
University of Hartford

Meghan Rickard
University of Hartford

As a result of a worldwide pandemic in March 2020, the people of the United States of America experienced a shock as many workers were literally moved overnight from working at desks in corporate offices, to performing virtual work at home. For some thesewere shared offices, many times makeshift, while also being utilized to home-school children. The COVID-19 pandemic forced businesses, large and small, to either close, orallow their workforce to work from their homes, with the intent to slow the spread of COVID-19 through social distancing. While some employees were already working virtually, or utilizing a hybrid working model, other employees were forced to work virtuallyfor the first time. When major changes occur in the working environment, managers are expected to oversee the transitions and support workers as necessary (Sirkin, Kennan &Jackson, 2005).

This is a pilot study. The purpose of this paper is to explore how workers experienced their supervisor's management of them in a virtual working environment during the mandatory social distancing resulting from COVID-19. It further expounds on the potentialto continue working virtually as offered by the participants of the study.

Gender Equality in Business and in Financial System

Nihal Bayraktar
Pennsylvania State University-Harrisburg

This paper investigates the empirical link between gender equality in businesses and financial inclusion of women. The research question is whether gender equality in accessto financial instruments and the share of women in businesses move together. The paperincludes tabular and graphical analysis as well as probit regressions. The empirical modelcontrols for many related variables, such as gender equality in education and the size ofinformal sector. The findings, indeed, support the expected results that improvements infinancial inclusion of females may go hand in hand with higher shares of female involvement in businesses. The findings of the paper have useful policy implications, suchas increasing the presence of women in the business world may require gender equalityin financial inclusiveness. Policies enhancing the presence of females in financial systemscan be a good starting point for gender equality in the work environment.

Emotional and Cultural Intelligences' Impact on Extra-Role Job Performance inRussia

Robert Engle
Quinnipiac University

Nikolay Dimitriadi
Rostov State Economic University

Katarzyna Toskin
Quinnipiac University

A great deal of work has been done in recent decades examining the impact of emotional intelligence (EQ) and cultural intelligence (CQ) on extra-role behavior and job performance. However, comparatively little of this research has used both EQ and CQ constructs when doing this. In addition, the available research literature is virtually silent with regards to the relationships of these constructs in Russia. Using the Thomas et al. (2015) model of CQ which separates motivational CQ from the Earley and Ang (2003) core CQ subconstructs, this study examines these relationships using a sample of 189 supervisory and non-supervisory subjects in Russia. The results suggest that motivational CQ is an antecedent of both CQ and EQ, both of which significantly impact extra-role job performance along with the control variables of supervisory work role and the degree of daily interpersonal interactions. EQ and CQ factors were also found to mediate the motivational CQ and job performance relationship. In addition, necessary condition analysis was completed adding to model insights. These results have potentially significant implications for current EQ-CQ model theories, which are discussedalong with study limitations and need for future research.

Session 35: 11:00 – Noon

Machine Learning/Trade/Accounting

Chair:

Lisa Walters
State University of New York-Fredonia

Applying Machine Learning to Classify Player Importance in the NBA

Azene Zenebe
Bowie State University

Nega Lakew
Bowie State University

Kirk Williams
Bowie State University

Players win or lose as a team; however individual players play important role in promotingteams and in advertisement. It is an important task to identify best players. This researchattempts to use machine learning to predict a player level of importance following the CRISP (Cross-Industry Standard Process for Data Mining) method and WEKA (WaikatoEnvironment for Knowledge Analysis) software. The research collects and cleans the 2018-19 regular season performance data from NBA.com and ESPN.com for 601 players.The features in data used for machine learning are games played, games started, minutes played, points scored, offensive rebounds, defensive rebounds, rebounds, assists, steals,blocks, turnovers, assists to turnover ratio, player efficiency and NBA's real plus minus (RPM) statistic. The RPM statistic, computed by sport analysts, is used to classify player'simportance with values: High (H) with RPM of +1.51 and above; Average (A) with 0 to +1.50; Low (L) with -0.01 to -3; and Very Low (VL) with -3.1 and lower. Using 10-fold cross-validation machine learning technique, the Logistic, Artificial Neural Network, and Random Forest machine learning algorithms perform relatively well with a classification accuracy of 68%, 67%, and 66%, respectively; compared to 25% accuracy for a randomguess. With more data, from other seasons, a better accuracy can be achieved. When new performance data come, the classifier models predict players' importance level without the involvement of sport analysts. This allows Teams know who are the most important players and therefore, know who are their most marketable players.

Would a US-India Free Trade Agreement Be Beneficial for India?

Neetu Kaushik
LaGuardia Community College, City University of New York

Niloufer Sohrabji
Simmons University

The paper examines the potential benefit of a U.S.-India free trade agreement (FTA). FTAs are expected to not only increase trade but also improve the structural compositionof trade towards higher valued goods and services. In turn, these improvements can raisereal GDP growth, create employment opportunities, support infrastructure investment, and improve other development indicators. We use a case study approach for our analysis. Specifically, we examine India's FTAs with advanced economies as well as U.S.FTAs with emerging markets to speculate about the changes in India's export position with the U.S. Through this we draw conclusions about the long-run potential benefits of aU.S.-India FTA. We will also analyze the impact of the possibility and the implications of an FTA due to the COVID-19 crisis.

Research Trends in Accounting Fraud Using Network Analysis
So-Jin Yu
State University of New York-Fredonia

Jin Sung Rha
Inha University

Accounting fraud is a highly unethical management activity with a significant negative influence on stakeholders, that can destroy a firm's long-term sustainability prospects. Given the considerable progress in this field, it is necessary to provide a comprehensive theoretical organization of the research along with a trend analysis. This study employs network text analysis to systematically analyze research trends in accounting fraud, by combining text mining techniques and network analysis. Unlike other research trend studies that present statistical data by classifying research topics and methodologies, thisstudy forms networks using trait information of studies such as "keywords" and "authors,"and engages in a variety of related analyses such as centrality and cluster analyses. Through these exercises, it is possible to identify key research areas and groups. Resultssuggest that literature on accounting fraud has been developed based on six keywords: fraud detection techniques, executive compensation, assessments of fraud risks in auditprocesses, forensic accounting, corporate governance, and various topics relating to top management. Overall, the authorship analysis suggests that the most contributing key authors in the clusters are Carpenter, Jones, Brazel, Zimbelman, Cohen, Cumming, Carcello, Kaplan, and Lennox.

Conference Concluded

In the interest of space, references for abstracts are available via request to the authors.

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