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The purpose of this journal is to assemble researched and documented ideas that help drive successful learning and motivate business students to learn. The intention is to draw ideas from across both methods and disciplines and to create a refereed body of knowledge on innovation in business education. As a result, the primary audience includes business education faculty, curriculum directors, and practitioners who are dedicated to providing effective and exciting education.

We invite you to read about innovations published and apply in your classroom. We also encourage you to develop your original creative ideas, prepare an article, and submit for review.

This particular issue includes a number of interesting classroom innovations in diverse areas.

Peter J. Billington  
*Editor*

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# An Analysis of Data Visualization Course Syllabi

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## ABSTRACT

Visualization skills are now considered a core competency of business and data analytics. This paper provides a detailed analysis of course descriptions, learning outcomes and assessment strategies, textbooks, and visualization software used from a study of thirty-three visualization course syllabi from a diverse set of higher educational institutions in the United States. The results from this survey can be helpful to faculty teaching visualization courses for the first time. It also provides a comparative analysis for faculty who currently teach courses in visualization.

**Keywords:** visualization, analytics, teaching visualization, visualization learning outcomes

## INTRODUCTION

The number of career openings in data science, business analytics, and related disciplines has been, and is, on an upward trajectory for the foreseeable future (Jiang and Chen, 2021). While the projected growth numbers may vary by source, there is a strong consensus among business leaders that data science and business analytics skills are core workforce competencies, regardless of the job function, company size, or industry (Fantoni et. al., 2020).

There are many reasons for the growing demand for analytics skills. We list four primary reasons:

1. The exponential volume and nature of data generated by individuals and organizations require new tools, technologies, and frameworks to analyze and process. Organizations are finding it increasingly challenging to understand and analyze massive volumes of organizational data. This makes it difficult to leverage data for competitive advantage. Organizations need analytics professionals who are trained to help decision-makers utilize high-quality, relevant, and timely data to increase the efficiency and effectiveness of decision-making.
2. Data is an engine that provides organizations with a competitive advantage. Data has monetization power in its own right and when deployed strategically, it can provide market advantages and benefits that are difficult to imitate. Organizations require analytics professionals who are trained to map insights derived from analytics to business strategy and compete effectively in the marketplace.
3. A sound data strategy is fundamental to organizational survival and sustainability. However, many organizations struggle to create and implement a meaningful data strategy that evolves with internal and external pressures and priorities. This is because data strategy requires a deep understanding of the nature of the business, its strategic direction, and competitive landscape, in-depth knowledge about the technology that drives analytics, and a collaborative management style that marshals people, processes, and technology resources to consistently deliver results. The importance of building quality data sources and databases, mapping existing data to business strategy, and leveraging data to achieve organizational goals requires business acumen and technical knowledge that usually only seasoned analytics professionals can deliver.
4. Large volumes of unexplored or unclean organizational data are a double whammy. Not only has the organization invested time and resources to collect this data, but the ROI on its data collection and storage efforts may be negligible if the data does not lead to better and more timely decisions. Poor-quality data often has the opposite effect. It results in delayed or ineffective decisions that can cause irreparable damage in terms of brand and reputation, a decline in revenues, talent attrition, and shrinking market share. Organizations need data analytics professionals who are sophisticated in data collection, quality, analysis, and management.

The exponential job growth projections and growing concerns about the severe shortage of qualified data scientists are the perfect storm for educational institutions (Gieger, et.al., 2018). Many colleges and universities around the world now offer undergraduate and graduate degrees, tracks, minors, and certificates in data science and business analytics (Hassan and Liu, 2019; Tang and Sae-Lim, 2016).

## VISUALIZATION: A CORE COMPETENCY IN ANALYTICS

One specific and highly sought-after analytics competency is the ability to create sophisticated visualizations that deliver critical insights. The human mind has only a limited capacity to process large volumes of structured and unstructured data. The larger the data set, the greater the number of variables, and the intricate relationships between them, the more difficult it is to make sense of such data. Given that visualization skills are a core and valuable competency in today's digital world, almost all programs in analytics offer visualization as a core course. This paper is a survey of thirty-three undergraduate and graduate syllabi in visualization courses taught by colleges and universities in the U.S. The objective of this study is to gain a deeper understanding of the key academic concepts, course descriptions, objectives, learning outcomes, assessment techniques, and textbooks and software used in visualization courses taught in the U.S. The paper is laid out as follows: we begin with a literature review followed by a description of our sample data. Next, we provide a summary of topics and core concepts covered in college and university visualization courses, course objectives, and learning outcomes, along with a list of the most popular software and textbooks used in visualization.

### LITERATURE REVIEW

A decade ago, Nolan and Temple Lang (2010) identified visualization as integral to understanding and applying statistics. Today, visualization is taught in undergraduate and graduate programs in a wide variety of disciplines, including computer science, data science and analytics, information systems, graphic arts, business, finance, and economics, to name a few. Owen et. al (2013) discuss the evolving nature of this discipline and emphasize the importance of faculty staying current with visualizations tools and concepts. Nestorov et. al. (2019) states that employers are increasingly looking to recruit students with strong visualization skills. Diamond and Mattia (2017) map the visualization skills sought after by the corporate sector and align them with courses in the business curriculum.

Visualization, particularly interactive visuals, has been found to help decision-makers and students gain critical domain-specific knowledge and enhance problem-solving skills (Saundage et. al., 2016)). Ryan et. al (2019) elaborates on the concept and definition of "skills" as it applies to visualization. Nolan and Perrett emphasize the important role that visualization skills play in comprehending statistics and its applications to the real world. Kammer et. al. (2021) discusses the pros and cons of using project-based learning to teach critical visualization concepts. The diverse academic backgrounds of students and the varying levels of academic preparation make teaching visualization a challenge for many faculty (Schwab McCoy et. al., 2021).

### DATA AND ANALYSIS

Our analysis is based on thirty-three syllabi: 31 collected from the web and two visualization syllabi from courses taught by the co-authors. We searched the web using the keywords "data visualization syllabus" with emphasis on college and university courses using Google and other search engines. The majority of the syllabi were PDF documents, and a few were in HTML or DOC format. Our research does not include any identifying content such as the instructor's name, course name, and number, or the name of the institution. Text from these syllabi was extracted using a Python program and pdfplumber package. The extracted text was concatenated into a single file and corrected for errors triggered by limited or inaccurate text extraction. This resulted in a single, consolidated syllabi text file. We analyzed five critical elements using the consolidated file:

1. Course descriptions
2. Learning outcomes and assessment strategies
3. Textbooks adopted
4. Visualization software used in the course.

Our findings are reported below as qualitative analysis, tables, and word clouds. Word clouds are extensively used to gain insights into textual data. For example, Park (2021) engages in textual analysis of abstracts from more than 300 research papers published in top-tier higher education in business journals and uses word clouds as well as formal textual analysis tools like Semantic Network Analysis and Latent Dirichlet Allocation.



## COURSE DESCRIPTIONS

Most syllabi had a section for course descriptions, although the titles varied, including Course Descriptions, Course Objectives, or just an Introduction. We did not separate the content based on title or sub-heading but based our analysis on the meaning of the content under different sub-headings. Our analysis shows that course descriptions included visualization principles, techniques, methods, and tools. It also often encompassed a broader set of critical concepts such as data literacy, information literacy, and communication skills. We provide a summary of critical ideas and concepts that we identified in the Course Description section of the visualization syllabi:

1. Ability to locate and analyze large public qualitative and quantitative data sets.
2. Technical knowledge to implement data cleaning and wrangling, data modeling, and data processing on data sets.
3. Ability to analyze and visualize different types of complex data and draw insights and conclusions using the principles of data literacy and the framework of information retrieval.
4. Ability to select the right type of visualization techniques for the right problem set including business, statistical, and scientific data sets.
5. Ability to critique and improve visualizations of a wide range of data sets and apply core principles and best practices of good visualizations to become more sophisticated consumers of visual information.
6. Understand the principles from diverse fields such as computer science, computer graphics, animation techniques, pattern analysis, computational methods, graphic design, visual art, perceptual psychology, human vision, informatics, and cognitive science.,
7. Acquire knowledge and skills to create and analyze information in the context of the human visual system.
8. Understand interdisciplinary data and observations intuitively and visually and weave them into powerful and engaging stories.
9. Create visualizations and interactive dashboards with multiple variables that align with the needs of the audience and their goals.
10. Use visualization as a problem-solving technique in diverse fields of study.
11. Learn to create geo maps from complex geospatial data.
12. Understand and apply ethical principles to visualizations to avoid misleading audiences.

## WORD CLOUD REPRESENTATION OF COURSE DESCRIPTIONS

Word clouds are effective tools to summarize the content of large chunks of text visually. They provide immediate and visual insights that help readers to understand the key concepts that may be hidden in the text. Word clouds emphasize the keywords in the text by displaying words that are more frequently used as larger text. Word clouds are not, however, rigorous analytics tools unless they are used in combination with other relevant tools. Our goal was to identify common keywords that instructors used in their course descriptions. These keywords convey the essence or key themes of visualization. To build a word cloud, we extracted the text from the course descriptions sections. We removed punctuation and “stop” words, formatted the remaining words into lowercase, and lemmatized the remaining words. Lemmatization puts inflections of a word in one bucket, i.e., determines their “lemma”, so that they can be analyzed together.<sup>1</sup> The text from course descriptions was fed into a word cloud package in Python. The resulting text cloud is shown in Figure 1.

The word cloud findings corroborate our qualitative analysis. Domain-specific words that are used with high frequency, but not necessarily informative are displayed prominently: *data*, *visualization*, and *course*. This is because word clouds give prominence to the frequency of word usage. A closer analysis of the word cloud shows three main pillars or content themes in visualization courses: tetical foundations, execution modes, and decision-making. First, the theoretical foundations of visualizations are derived from the interdisciplinary nature of the domain. These words include technique, concept, design, visual, method, computer, science, encoding, principle, and perception. Second, the word cloud captures the execution modes of visualizations: chart, software, dashboard, representation, present, graphic, tool, develop, practice, and similar keywords that capture the experiential or hands-on nature of visualization courses. Finally, the goal of leveraging visualizations to aid in decision-making and generating insights captured in words such as decision, analysis, understanding, learning, and communicating.



- **Create Interactive Dashboards and the Art of Storytelling Through Visuals**
  - Learn key principles of data identification, data cleaning and wrangling, data models, and graphical techniques to create effective visuals using a structured design process
  - Create static and interactive dashboard visualizations that align with best design practices
  - Ability to identify and align the right charts, graphs, and algorithms with the nature and scope of problems in different domains.

Student learning outcomes (SLOs) are useful because they frequently capture emerging trends, accreditation requirements, alignment with program mission, and workforce demands. We summarize the core findings of the skills, abilities, and competencies students are expected to acquire from the Learning Outcomes sections of our sample visualization syllabi.

- **Foundational Skills**
  - Data Literacy
  - Understand and apply principles of data visualization.
  - Engage and discuss the information embedded in visualizations.
  - Develop an understanding of data visualization theory.
  - Deconstruct a graphic into the data displayed.
  - Apply data transformations such as aggregation and filtering for visualization
  - Display core competencies to clean, format, and analyze data before visualization
  - Understand and execute effective project management strategies, tools, techniques, and frameworks
  - Embed principles from computer graphics, graphic design, visual arts, perceptual psychology, and cognitive science to enhance the audience's understanding of complex visuals
  - Understand and implement basic statistical concepts and models to analyze data and its limitations
  - Understand the appropriate use of variables, conditionals, loops, functions, and table calculations.
- **Tools**
  - Gain experience in using popular data visualization tools
  - Be able to create interesting and insightful dashboards using select software tools
  - Deliver exceptional communication skills to effectively narrate the story behind the data
  - Understand the architecture, cloud-based models, and limitations of the software.
- **Critique**
  - Explain best practices that can improve the expressiveness and effectiveness of data visualizations critique visualizations and know how to fix them; use research methods
- **Miscellaneous**
  - Remedial linear algebra; eigenanalysis of real symmetric matrices; HTML, CSS, Scalable Vector Graphics, Javascript; d3: selections, scales, transitions, events, Isomap, LLE, t-SNE, Hierarchies and Networks, Principal Component Analysis, and Multidimensional Scaling

## WORD CLOUD REPRESENTATION OF LEARNING OUTCOMES

Figure 2 displays prominent words that emphasize the common goals found in many Data Visualization courses. Parallel to our above qualitative analysis, fundamental concepts are well represented (perception, understanding, understand, principle, basic, learn). The how-to's of data visualizations are prominent: visualizations, data, design, technique, use, apply, interactive, and implement.

Another aspect of the learning outcomes is statistical analysis in a critical manner using appropriate tools. Words like statistical, analyze, develop, dataset, tool, critique, analysis, question, algorithm, create, and implement can be thought of as manifestations of this focus. Finally, effectively telling a story based on data is also shown clearly in the word cloud: effective, communication, appropriate, presentation, present critique, information, and interactive can be seen as related to this learning outcome.

Our research showed that faculty teaching visualization courses use standard tools to assess the above learning outcomes, such as quizzes, exams, mid-terms, final exams, assignments, lab exercises, projects, research papers, discussions, experiential learning, and e-career portfolios.





**Table 1: Textbooks Used in Data Visualization Courses**

This table shows the textbooks in 33 Data Visualization course syllabi as either required (Req.) or optional / recommended (Opt.), sorted by the total number of mentions. The first group has textbooks that have been mentioned 4 or more times, the second group has books that have been mentioned 2-3 times and the last group has textbooks that have been mentioned once.

Name	Author	Req.	Opt.	Total
The Visual Display of Quantitative Information	Edward R. Tufte	5	3	8
Visualize This: The FlowingData Guide to Design, Visualization, and Statistics	Nathan Yau	4	3	7
Interactive Data Visualization for the Web: An Introduction to Designing with D3	Scott Murray	2	4	6
Now You See It	Stephen Few	4	2	6
Show Me the Numbers	Stephen Few	4	2	6
Visualization Analysis and Design	Tamara Munzner	3	1	4
ggplot2: Elegant Graphics for Data Analysis	Hadley Wickham	0	3	3
The Functional Art: An Introduction to Information Graphics and Visualization	Alberto Cairo	1	2	3
Information Dashboard Design: Displaying Data for At-a-Glance Monitoring	Stephen Few	1	2	3
The Big Book of Dashboards: Visualizing Your Data Using Real-World Business Scenarios	Steve Wexler, Jeffrey Shaffer, and Andy Cc	3	0	3
Envisioning Information	Edward R. Tufte	2	0	2
Data Visualization: Principles and Practice	Alexandru C. Telea	1	1	2
Storytelling with Data: A Data Visualization Guide for Business Professionals	Cole Nussbaumer Knaflic	0	2	2
Good Charts: The HBR Guide to Making Smarter, More Persuasive Data Visualizations	Scott Berinato	1	1	2
Visual Thinking for Design	Colin Ware	0	2	2
Fundamentals of Data Visualization	Claus O. Wilke	2	0	2
Practical Tableau: 100 Tips, Tutorials, and Strategies from a Tableau Zen Master	Ryan Sleeper	2	0	2
The Wall Street Journal Guide to Information Graphics: The Dos and Don'ts of Presenting Data,	Dona M. Wong	0	2	2
Data Points: Visualization That Means Something	Nathan Yau	0	2	2
R Graphics Cookbook: Practical Recipes for Visualizing Data	Winston Chang	0	1	1
The Truthful Art: Data, Charts, and Maps for Communication	Alberto Cairo	0	1	1
Creating More Effective Graphs	Naomi Robbins	1	0	1
JD Long & Paul Teetor. 2019. R Cookbook: Proven Recipes for Data Analysis, Statistics, and Gr	JD Long and Paul Teetor	0	1	1
The Non-Designer's Design Book	Robin Williams	0	1	1
D3 Tips and Tricks	Malcolm Maclean	1	0	1
Mastering d3.js	Pablo Navarro	0	1	1
Real Time Analytics	Byron Ellis	0	1	1
Interactive Data Visualization: Foundations, Techniques, and Applications	Matthew Ward, Georges Grinstein, and Dar	1	0	1
Introduction to Information Visualization	Riccardo Mazza	0	1	1
Visualization Handbook	Charles D. Hansen and Chris R. Johnson	0	1	1
Data Visualization with Python	Dobler and Grobmann	1	0	1
Mastering Python Data Visualization	Kirithi Raman	0	1	1
Tableau Your Data!: Fast and Easy Analysis with Tableau Software	Daniel Murray	0	1	1
Design for Information	Isabel Meirelles	0	1	1
Communicating Data with Tableau	Ben Jones	1	0	1
Data Visualization Made Simple: Insights into Becoming Visual	Kristen Sosulski	1	0	1
D3.js in Action	Elijah Meeks	0	1	1
Semiology of Graphics	Jacques Bertin	0	1	1
The Grammar of Graphics	Leland Wilkinson	0	1	1

## VISUALIZATION SOFTWARE USED IN THE COURSE

Almost all syllabi mention the importance of building visualization skills and knowledge in at least one popular software or programming language, while some incorporate several different software packages and programming languages. We can broadly classify the software as programming-oriented or tool-oriented with a few courses aiming for a blend of the two approaches.

Among programming-heavy courses, there was a stronger web focus. Javascript and its D3 package (commonly used for web-based, interactive visualizations) are popular. For R, shiny, a package along the same lines as D3 is popular.

For tool-oriented courses, Tableau was the most popular as it was the software of choice in fourteen of the thirty-three syllabi we analyzed. Excel was also a primary or secondary software in several courses.

**Table 2: Software Used in Data Visualization Courses**

This table shows the software used in 33 Data Visualization courses. Some courses are programming oriented and some are tools-oriented. A few courses focus on both.

<b>Programming-oriented courses</b>	<b>Count</b>	<b>Details</b>
javascript	11	D3, HTML, CSS
R	8	shiny, ggplot
Matlab	3	
C/C++	2	
Python	2	
	<hr/>	26
<b>Tools-oriented courses</b>		
Tableau	14	
Excel	4	
	<hr/>	18
<b>Summary</b>		
Programming focused courses	16	
Tools- focused courses	10	
Both	5	
Unknown	2	
	<hr/>	33

## CONCLUSION

We analyzed 33 syllabi on visualization courses from diverse higher education institutions. We analyzed the course descriptions, textbooks and software used, and learning outcomes and assessments. Our analysis shows that the foundational skills and competencies are common and emphasized in a majority of visualization skills. However, there is a divergence in the nature, scope, and depth of technical skills taught in visualization courses. Our observations on assessments show that traditional evaluation approaches such as quizzes, exams, and project-based learning are predominant.

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# M&M's<sup>®</sup>, Sampling, and x-bar/R Control Charts: A Demonstration and Validation

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## ABSTRACT

Relaying statistical concepts to students is difficult without “real-world” examples and corresponding data. However, it is difficult to obtain data for student usage, let alone have the data mean something to the student. This paper attempts to provide students with a hands-on demonstration to aid in their understanding and application of control charts using the tangibility of M&M's<sup>®</sup>. During the demonstration, students gain an understanding of how to perform sampling, evaluate basic statistics, and leverage tangible data to create x-bar & R charts. The demonstration's effectiveness is then assessed using a post-hoc data analysis of student examination data to evaluate the demonstration's effect on student performance.

**Keywords:** control charts, M&Ms, SPC, x-bar chart, R chart

## INTRODUCTION

Statistical process control (SPC), first introduced by Shewhart (1926), provides the ability of a firm to monitor and control the production process. Many companies have leveraged SPC in the form of control charts, and in particular the x-bar and R charts. When used effectively, a firm has the ability to monitor a process during normal operations to determine if the process is “in control” or to determine if corrective action is needed (Sanders and Reid, 2013; Swink et al., 2017). As a result, control charts have become important cornerstones of quality initiatives, such as Six Sigma (Goh and Xie, 2003), and have been used in a variety of industries. Given the importance of the topic, it is necessary for students to leverage data, construct control charts, and interpret the results. This makes experiential learning a vital part of the learning process.

Experiential learning provides a “real-life,” dynamic, learning environment where students can learn concepts and apply them in a controlled manner. Of note, it has been demonstrated that experiential learning through classroom demonstration can assist student learning and application of statistical process control (SPC) – in particular, control chart concepts (e.g. Fish, 2009; Fish and Braunscheidel, 2012). To this end, there have been several teaching activities that have used candy, such as M&M's<sup>®</sup>, in demonstrations that have explained the construction of c-charts (Fish, 2009; Fish and Braunscheidel, 2012) and provided process capability demonstrations (Lembke, 2016). However, there has been a limitation in activities that directly address the construction of x-bar and R charts in the literature (e.g., Fish, 2007; Hill and Schvaneveldt, 2011), and the associated validation of the demonstrations' impact on student performance. The purpose of this paper is to provide instructors a method for incorporating an inexpensive, experiential-learning activity/demonstration to enhance student learning of x-bar and R control charts; and then assess the effectiveness of the demonstration using a statistical analysis using examination data.

Next, the paper will address what has been previously done in the literature to demonstrate the construction of control charts. This will be followed by the design of the classroom demonstration of using M&M's<sup>®</sup> to construct control charts; which will also provide a justification of why M&M's<sup>®</sup> are a reasonable, normally-distributed product appropriate for constructing x-bar & R charts. Finally, an analysis will be presented to show that participation in the M&M<sup>®</sup> control chart demonstration improved student performance on x-bar & R chart exam questions.

## PREVIOUS RESEARCH

Several authors have constructed demonstrations and activities that utilize x-bar & R charts. Rada and Hu (2002) demonstrated the application of evaluating student-student comments utilizing x-bar & R charts to detect variation in student responses. Coy (2016) evaluated the steps of plan, do, check, act (PDCA) with students constructing x-bar & R charts to evaluate the length of time required to construct paper squares. Additionally, several authors have supplemented their class projects of building catapults (Mitchell et al., 2013) or paper helicopters (Johnson, 2011) to explore the value of x-bar and R charts. However, in many of these activities, multiple class periods or time outside of class are required for students to fully learn the SPC concepts and the control charts are used to supplement another activity.



Fish (2007) provides a method of direct instruction that is intended to explicitly teach  $\bar{x}$  and R chart construction – using string length. However, their instruction is not validated with data and limits the number of participants. The demonstration presented in this paper provides a modification that allows for complete classroom participation while additionally assessing the impact on student exam performance. The demonstration presented in this paper does the following: 1) provide a low cost, interactive demonstration toward the construction of  $\bar{x}$ -bar & R charts and 2) evaluates the effectiveness of the demonstration through the usage of exam data.

## DEMONSTRATION DESIGN

### The normality of fun-sized M&M's®

This demonstration requires the usage of an individually packaged snack item. Preferably uniform in nature; this demonstration used “fun-sized” packets of M&M's®. Given that there will be a variation in the number of M&M's® present in the fun-sized bag, the instructor started by sampling the fun-sized M&M's® packets to estimate the mean and standard deviation for the population. At the time of this paper being submitted, the mean ( $\mu$ ) was estimated to be roughly 15.25 M&M's® per fun-sized package with a standard deviation ( $\sigma$ ) of 0.96. The population estimation is best done by purchasing a set of fun-sized M&M's®, counting the number of M&M's® in each fun-sized packet, and then calculating the mean and the standard deviation. While the counting of M&M's® is generally discrete (i.e., associated with the Poisson distribution), many fun-size packets of M&M's® contain broken or malformed M&M's®. This allows students to estimate partial numbers of M&M's® and obtain an approximated, continuous measurement of the “count.” However, it is important to inform students that traditional forms of continuous measurement (e.g., weight, mass, length) would be better suited for  $\bar{x}$ -bar and R charts.

Given that  $\bar{x}$ -bar & R charts assume a normal (i.e., Gaussian) distribution, the normality of the M&Ms® population contained in a fun-sized packet was estimated by sampling 128 fun-sized packets. Based upon the Shapiro-Francis ( $p = 0.82$ ) and Shapiro-Wilk ( $p = 0.42$ ) tests, the assumption of normality cannot be rejected. Additionally, skewness was not a concern with the population. The assumption of normality is also supported by Lembke (2016), who demonstrated in their activity that the weight varies with each fun-sized packet, the weight of the fun-sized packets appears to be normal, and the M&M's® themselves vary in mass.

### Classroom Demonstration

Prior to the class demonstration, the class received instruction on the basics of SPC via a traditional lecture. Based upon their required coursework, they were additionally familiar with the concept of a statistical distribution, how to calculate the mean and standard deviation of the distribution, and how to calculate the sample standard deviation from the population standard deviation. For the purposes of this demonstration, the instructor relied on the texts of Sanders and Reid (2013) and Swink et al. (2017) for the basis of the control chart formulations.

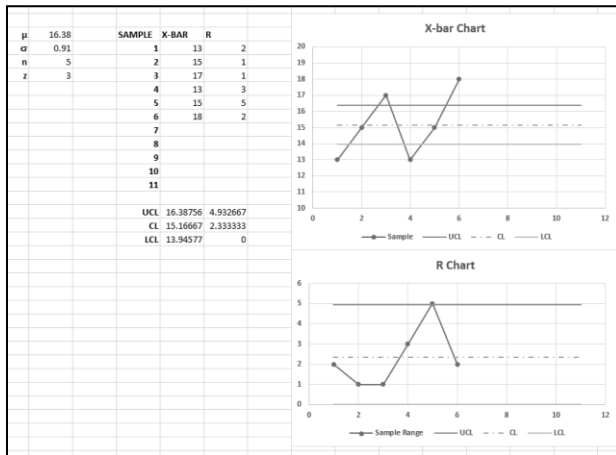
Each student is given a packet of M&M's® and assigned to a group. Each group is comprised of five students. Students were informed that malformed and partial M&M's® should be estimated as a fractional/decimal amount. Each group will be a sample ( $i$ ) of five packages ( $n$ ). The student will count the whole and fractional number of M&M's® within their packet ( $x_n$ ) and then calculate the sample mean ( $\bar{x}_i$ ) with their group – see equation (1). Additionally, each group will also determine their sample range ( $R_i$ ) – see equation (2).

$$\bar{x}_i = \frac{\sum(x_n)}{n} \quad (1)$$

$$R_i = \max\{x_n\} - \min\{x_n\} \quad (2)$$

When they have calculated the sample mean and range, they will enter their values on a predesigned spreadsheet (or comparable medium) that is available for the class to see via an overhead projector (See Figure 1).

Figure 1: Example of spreadsheet used by the classes



Once all groups ( $k$ ) have reported their sample means and ranges, have all the students calculate the grand mean ( $\bar{\bar{x}}$ ) and the average sample range ( $\bar{R}$ ). These will be the center lines (CL) for their control charts:

$$\bar{\bar{x}} = \frac{\sum_{i=1}^k \bar{x}_i}{k} \quad (3)$$

$$\bar{R} = \frac{\sum_{i=1}^k R_i}{k} \quad (4)$$

Utilizing the spreadsheet in Figure 1, the answers can be hidden from students until they have calculated grand mean and the average range. Validate that they have properly calculated the grand mean and the average sample range. Next students construct their control charts. The students will calculate the upper control limit (UCL) and the lower control limit (LCL) for the x-bar chart using three sample standard deviations ( $\sigma_{\bar{x}}$ ); however, this could be substituted by using  $A_2$  from the control chart constants along with the average range ( $\bar{R}$ ).

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} \quad (5)$$

$$UCL_{\bar{x}} = \bar{\bar{x}} + 3\sigma_{\bar{x}} \cong \bar{\bar{x}} + A_2\bar{R} \quad (6)$$

$$LCL_{\bar{x}} = \bar{\bar{x}} - 3\sigma_{\bar{x}} \cong \bar{\bar{x}} - A_2\bar{R} \quad (7)$$

Similarly, the students will construct the R-bar chart control limits using the table of control chart constants  $D_3$  and  $D_4$  [see equations (8) and (9)].

$$UCL_{\bar{R}} = D_4\bar{R} \quad (8)$$

$$LCL_{\bar{R}} = D_3\bar{R} \quad (9)$$

The students should then be instructed to build the upper and lower control chart limits and draw the control charts. For this demonstration, the classroom had white boards along the walls of the classroom allowing students to build up their control charts publicly. This allowed the instructor and their fellow students could see what they had done.

## RESEARCH DESIGN AND ANALYSIS

In past there has been a lack of analysis evaluating whether x-bar & R chart demonstrations/activities have an effect on student performance. This presented the following, simple research question: does participation in the M&M<sup>®</sup> control chart demonstration result in higher exam performance than nonparticipation? To evaluate this research question, data were collected and analyzed using multiple semesters of exam data to determine if there is a greater likelihood of students correctly answering x-bar & R charts questions.

## Data Collection

The student data were collected over five semesters. All sections were given a lecture on the construction of control charts and how to assess process capability. However, unlike the first three semesters of instruction, the demonstration was incorporated into the lecture for the latter two semesters. The outcome data were then collected from each section's examinations post-hoc. This resulted in a total of 477 students with an average class size of 53 students. Given the prerequisites of the course, the students were juniors and seniors that were admitted to the business college. Based upon the students answering of the control chart questions on their second exam, 462 students answered the x-bar chart question, while only 459 students answered the R chart question. Correct answers were coded as "1" and incorrect answers were coded as "0." Table 1 shows a breakdown of students (as a percentage) based upon their participation in the activity and their respective performance on x-bar and R chart questions.

**Table 1: Comparison of M&M<sup>®</sup> demonstration participation and percent correctly answering exam questions**

	% Correct on x-bar chart	% Correct on R chart
Class with no M&M (MM = 0)	33.66 (n = 305)	19.93 (n = 305)
Class with M&M (MM = 1)	46.50 (n = 157)	48.70 (n = 154)

## Variables and Controls

**Independent variable:** The variable MM was coded as "1" for those students who participated in the M&M's<sup>®</sup> demonstration and coded as "0" for those students who did not participate in the M&M's<sup>®</sup> demonstration. This acted as the treatment for the analysis.

**Dependent variables:** Each semester students were asked similar questions on their exams – with varying numbers – regarding the x-bar (x-bar Chart) and R (R Chart) charts – see Figure 2. Their propensity to answer each question correctly was extracted from their Scantron exam reports and coded as a "1" if they answer the corresponding question correctly, and "0" if they did not.

**Figure 2: Sample exam questions given to students each semester**

Given a system standard deviation = 0.90 and $z=3$ , use the following table for the next two questions:					
		Sample			
		1	2	3	4
Observation	1	14	17	11	9
	2	16	15	15	9
	3	12	10	10	15

- Given the previous table, what is the lower control limit (LCL) for the x-bar chart?
  - 10.325
  - 15.450
  - 14.309
  - 11.191
  - 10.050
- Given the previous table, what is the upper control limit (UCL) for the r chart?
  - 0
  - 5.500
  - 12.750
  - 12.551
  - 14.163

**Control variables:** given that these data were collected over multiple semesters, semester (Semester) was controlled for starting with "1" = fall semester 2016 and adding a subsequent number for each semester taught thereafter until "5" = fall semester 2018; summers semesters were not taught, and thus not included in the count. The sex (Female) of the student was also controlled for with female students coded as "1" and male students coded as "0." This was done since the literature indicates male and female students may have differing levels of performance during participation-based, math activities (Peterson and Fennema, 1985). Additionally, Rieggle-Crumb and Humphries (2012) identify that within math instruction there is the potential for bias towards female students, even if implicit or unintended. Finally, since past student performance is typically an indicator of future performance, the exam grade (Prior Exam Score)

from their first exam was used as a control.

### Data Analysis & Results

Given the dependent variables (x-bar Chart and R Chart) are binary in nature (i.e., incorrect/correct), the data were analyzed using a logit regression. Logit regression is preferred over a linear probability model (i.e., linear regression) since the analysis specifically accounts for the binary outcome (Wooldridge, 2015). Additionally, since the data were collected over multiple semesters, and also differing sets of students, the data were considered a pooled cross-sectional data. To account for the pooled cross section, the time variable (i.e., Semester) was included in the logit regression to account for any changes in the outcome due to time (Wooldridge, 2015).

Table 2 shows the results of the logit regression. As shown in Table 2, there is a positive and significant effect of MM on students correctly answering the x-bar ( $b = 1.292, p < 0.01$ ) and the R ( $b = 1.686, p < 0.001$ ) chart questions. By calculating the odds ratios (O/R) from the logit regression coefficients, it is shown that participants in the M&M<sup>®</sup> demonstration were, on average, much more likely to correctly answer the x-bar question (O/R = 3.640, 95% CI = [1.64, 8.09]) and the R chart question (O/R = 5.396, 95% CI = [2.21, 13.16]). Based upon the odds ratio, students that participate in the demonstration were, on average, 3.64 times more likely to answer the x-bar chart question correctly, and 5.40 times more likely to answer the R chart question correctly. This demonstrates that there is positive and significant effect on student exam question performance when students participated in the M&M<sup>®</sup> control chart demonstration.

**Table 2: Logit regression results of M&M's<sup>®</sup> demonstration on x-bar and R chart questions**

	x-bar Chart (Model 1)	R Chart (Model 2)
Female	-0.061 (0.203)	0.319 (0.222)
Semester	-0.267 (0.150)	-0.073 (0.174)
Prior Exam Score	0.586*** (0.119)	0.646*** (0.130)
MM	1.292** (0.407)	1.686*** (0.455)
Constant	-0.222 (0.333)	-1.520*** (0.398)
AIC	580.642	497.825
N	462	459
Pseudo R <sup>2</sup>	0.069	0.122

Two-tailed test; \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

### DISCUSSION

The M&M's<sup>®</sup> x-bar & R chart demonstration is a hands-on, experiential exercise that allows for a tangible example in the construction of control charts. The result of the analysis shows a positive and significant relationship between the usage of the demonstration and the propensity for a student to correctly answer exam questions related to the x-bar & R control charts. This demonstration also expands the work of Fish (2009) allowing for instructors to utilize fun-sized packets of M&M's<sup>®</sup> for both x-bar/R charts in addition to the construction of c-charts. Furthermore, with the analysis showing that participation in the M&M<sup>®</sup> control chart demonstration is associated with higher exam question performance, there is likely a similar benefit to other activities also constructing x-bar and R charts, such as those presented by Fish (2007) and Hill and Schvaneveldt (2011).

## Limitations

The greatest issue when attempting to generate data for  $\bar{x}$  and R charts is the need for continuous data. While fun-sized packets of M&Ms<sup>®</sup> provide malformed and broken pieces, M&Ms<sup>®</sup> are generally viewed to be discrete. Fish (2007) attempted to create an opportunity to construct control charts with string lengths. This ultimately requires the instructor to artificially create data and use a medium that may not stimulate the students in the activity. Additionally, Hill and Schvaneveldt's (2011) usage of baseball statistics leverages real data, but the data might intimidate students. However, these more continuous mediums (i.e., string and baseball), might provide students a better understanding of when it is appropriate to use  $\bar{x}$  and R charts. To remedy the issue with count data in this demonstration, it is recommended to use scales to measure the mass of the M&Ms<sup>®</sup> packets (cf., Lembke, 2016). This would allow for a continuous measurement of the M&Ms<sup>®</sup> packets while minimizing the change to the demonstration.

While the effect size of the M&M's<sup>®</sup> demonstration was lower for the  $\bar{x}$ -bar question, further exploration of the exam questions was performed. It was noted that several students used the population standard deviation ( $\sigma$ ), instead of the sample standard deviation ( $\sigma_{\bar{x}}$ ), when responding to the  $\bar{x}$ -bar chart question. This may account for the lower impact the M&M's<sup>®</sup> demonstration had on that particular outcome. However, this difference could also be explained by the difference in the populations. For example, nonparticipants generally scored lower in the R chart question. The larger effect size may instead be the result of the gap between participants and nonparticipants being larger for the R chart question.

Finally, given that the pseudo r-squared is low, there is the potential for additional student activities or supplements (e.g., homework) to be assessed in conjunction with the demonstration. It also further exemplifies the difficulty in achieving student success in the classroom even in the presence of class activities and demonstrations.

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# Priming Compassion in College Students

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## ABSTRACT

We conducted two studies relating to compassion, integrating behaviors, and thriving in college students. In the first study, we primed compassion (by providing compassion training to college students and having them journal about their own attitudes and acts of compassion for four weeks) and examined the relationship between compassion and integrating behaviors (other-report) and thriving. In the second study, we primed compassion (by having students read a salient story about compassion) and examined the relationship between compassion and integrating behaviors and the vitality component of thriving. Through the development of these two primes, we discovered that compassion has a strong association across primes with integrating behaviors (other-report and self-report) and thriving (self-report). These findings are essential to our understanding of these constructs and to our capacity to foster compassion, integrating behaviors, and thriving among college students. Going forward, we plan to incorporate additional, and more elaborate, compassion-based priming activities in the classroom and in broader contexts.

**Keywords:** Compassion, Integrating Behaviors, Thriving

## INTRODUCTION

In this article, we explain how and why we primed compassion among college students through journaling and reading stories about compassion. We elaborate on the importance of priming compassion and in fostering integrating behaviors and thriving outcomes through self-report and other-report assessments. Other-report assessments are valuable in that they come from others who are in a position to observe the behavior of the focal individual (e.g., the person providing the self-report assessments). In our case, other-report assessments came from the teammates of the focal individual. These teammates regularly interacted with the study participants in class exercises and class assignments and were in a position to evaluate the behaviors of the focal individual. This approach is consistent with Podsakoff, MacKenzie, Lee, & Podsakoff (2003) and Spector (2006) who note the value in using self-report assessments to evaluate intra-personal processes (e.g., attitudes, beliefs, perceived behaviors, and experiences) and other-report assessments to evaluate inter-personal processes (e.g., observed behaviors). This approach helps reduce common method bias (Podsakoff et al., 2003) and can offer a broader and more objective assessment of the reported behavior (see Spector, 2006).

With a theoretical foundation in positive organizational scholarship (Cameron, Dutton, & Quinn, 2003), we focus on warmth and kindness, sensitivity to the suffering of others, and a desire to understand and alleviate the suffering of others (all components of compassion) as powerful drivers of generative outcomes (e.g., integrating behaviors and thriving). We introduce two compassion primes (both of which are contrasted with a control condition)—one prime that is enduring (it includes compassion training and four weeks of journaling prior to having the participants respond to the survey questions) and one prime that is immediate (it includes having the participants read a salient story about compassion prior to immediately responding to the survey questions). We know that compassion can be developed, cultivated, and primed (see Jazaieri, et al., 2013; Weng et al., 2013), but, to our knowledge, we do not have a clear understanding of the differential effects of enduring versus immediate primes of compassion—nor we do understand the relationships between compassion and integrating behaviors and compassion and thriving. This research aims to fill these knowledge gaps and augment our understanding of a generative predictor (compassion) and generative outcomes (integrating behaviors and thriving)—with the overarching purpose of fostering compassion in college students.

## COMPASSION

Compassion is defined as warmth and kindness, sensitivity to the suffering of others, a desire to understand the suffering of others, and a commitment to alleviate and prevent such suffering (Dutton, Workman, Hardin, 2014; Gilbert, 2014). Compassion is associated with increased well-being, pro-social behaviors, social mindfulness, relational connection, resilience, grit, loyalty, trust, exploration and creativity, and job satisfaction (see Bach, & Guse,

2015; Davidson & Harrington, 2002; Dutton, Workman, Hardin, 2014; Dutton, Worline, Frost, & Lilius, 2006; Goetz, Keltner, & Simon-Thomas, 2010; Seppala, Simon-Thomas, Brown, Worline, Cameron, & Doty, 2017).

## **INTEGRATING BEHAVIORS**

Integrating behaviors are part of the two-dimensional managerial grid (Blake & Mouton, 1982; Stogdill, 1974) wherein individuals engage in assertive (or active) behaviors as well as respectful (or desirable) behaviors (Cropanzano, Anthony, Daniels, & Hall, 2017). Integrating behaviors honor agency, build consensus, establish clear relational boundaries and expectations, and involve the relational other as a genuine collaborator whose needs are as important as the needs of the focal individual. Integrating behaviors are important because they are a predictor of performance, productivity, creative tension, emotional intelligence, healthy conflict, constructive disagreement, structured problem solving, connection, job satisfaction, commitment, engagement, and relational resilience (see Cropanzano et al., 2017; Dutton & Heaphy, 2003; Swann, Johnson, Bosson, 2009; Thompson, 2012; Thompson & Ravlin, 2017). We propose that compassion is associated with higher levels of integrating behaviors, both other-report and self-report. When compassion is the result of an enduring prime (e.g., writing about compassion for four weeks and relating it to personal experiences), this will be associated with other-report of integrating behaviors because the long-term prime will influence how the focal individual treats the relational other. When compassion is the result of an immediate prime (e.g., reading a salient story about compassion and immediately responding to survey questions), this will be associated with self-report of integrating behaviors because the immediate prime will influence the focal individual's attitude toward the relational other and their desire to enact integrating behaviors. Compassion, a predictor of generative outcomes (Cameron et al., 2003), softens individuals and motivates warm responses, facilitates respect, and generates attentiveness to relational concerns while activating an assertive interest in the agentic needs of the focal individual and the relational other (Cropanzano et al., 2017) over time (in shaping behaviors) and immediately (in shaping attitudes). Thus, we hypothesize:

Hypothesis 1a: Compassion, that is the result of an enduring prime, is positively associated with integrating behaviors (other-report).

Hypothesis 1b: Compassion, that is the result of an immediate prime, is positively associated with integrating behaviors (self-report).

## **THRIVING**

Thriving is a two-dimensional construct comprised of vitality (having positive energy available) and learning (continuing to acquire knowledge) (Spreitzer et al., 2005) and “highlights the importance of simultaneously considering the affective and cognitive foundations of human growth” (Porath et al., 2012, p. 251). The vitality component refers to having a heightened sense of meaning, greater emotional carrying capacity, pleasurable affective responses, and augmented intrinsic motivation while the learning component refers to engaging in self-discovery, increasing cognitive capacity, and gaining relevant knowledge (Porath et al., 2012). Vitality tends to be associated with the hedonic component of well-being while learning often relates to the eudaimonic component (Kleine et al., 2019). Thriving is malleable, fluid, and temporary state that is predicted by self-determination, need for attachment, and meaningfulness (Goh et al., 2022). Thriving is important because it leads to increased well-being, self-development, self-regulation, sense of purpose, and sense of empowerment (Goh et al., 2022; Kleine et al., 2019; Porath, et al., 2012; Spreitzer et al., 2005). We propose that compassion is associated with higher levels of thriving. When compassion is the result of an enduring prime (e.g., writing about compassion for four weeks and relating it to personal experiences), compassion will be associated with both the vitality component of thriving (energizing, instilling meaning, and infusing with positive emotion) and the learning component of thriving (focusing attention, clarifying priorities, and gaining advanced knowledge) (see Goh et al., 2022). When compassion is the result of an immediate prime (e.g., reading a salient story about compassion), this will be associated with only the vitality component of thriving (energizing, instilling, meaning, and infusing with positive emotion). We would not expect an association with the learning component of thriving (gaining advanced knowledge, etc.) because of the nature of the immediate prime. Although, the immediate prime would provide a vitality boost (due to vitality being more closely associated with affective foundations), there would not be sufficient time to increase learning (due to learning being more closely associated with cognitive foundations) (Porath et al., 2012). Thus, we hypothesize:

Hypothesis 2a: Compassion, that is the result of an enduring prime, is positively associated with the vitality component of thriving and the learning component of thriving (self-report).

Hypothesis 2b: Compassion, that is the result of an immediate prime, is positively associated with only the vitality component of thriving.

## PRIMING COMPASSION (STUDY 1)

Compassion scholars have established that compassion can be developed, cultivated, and primed (see Jazaieri, et al., 2013; Weng et al., 2013). For study 1, we randomly assigned undergraduate students from a university in the Mountain West United States to either the compassion condition (treatment condition) or the control condition. Participants in both conditions participated in a five-week study. In the first week, participants in the experimental condition completed an initial survey and viewed a video training on compassion. As part of the training, participants in the treatment condition developed a personal compassion plan wherein they identified potential compassion opportunities in their lives. In weeks two through four, participants in the treatment condition completed weekly reflective journal entries about their feelings and acts of compassion, described how their compassion-focused efforts affected them, and elaborated on their compassion-focused plans for the upcoming week. We had participants engage in reflective journaling because reflective journaling can serve as a self-persuasion mechanism in shaping attitudes and behavioral intentions such that it functions as an enduring and powerful behavioral prime (Pennebaker, 2000; Petty & Cacioppo, 1986). In week five, the participants completed one more journal entry and a final survey. Participants in the compassion condition, wrote about the value of experiencing compassion and in offering compassion to others. For example, participants in the compassion condition wrote the following in their journal entries:

“We always have to assume people are doing the best that they can and it’s easier to assume that when you are thinking about ways to be compassionate toward others. Being compassionate is a skillset that can be learned. As I wrote about compassion and tried to practice it in my life, I have definitely become a more compassionate person.”

“In writing about compassion and trying to become more compassionate in my treatment of others, I really started to reflect on my life—to reflect on how I treat others and how I feel about them when they suffer.”

“As I have written about compassion, I have learned to listen better, to let others express their frustration without judging them and then do what I can to help them.”

“I have learned that if we are feeling compassion for someone else we will take it upon ourselves to slow down, sit and listen, and truly desire to relieve their suffering instead of just wanting to run away. I used to always just want to run away. Now, I see the value in sitting with people in their pain.”

“When it comes to compassion, I have run through countless scenarios of what could be the reason for someone acting rude, being snarky, cutting me off, acting grumpy, talking negatively about others, and driving slow or fast. I often take a second to think of why I sometimes do those things listed previously. Often it is just a mistake, I didn't see them, I’m late for something important, or I had a really hard day. I’m not normally like that. Knowing that I do the same thing and thinking of other scenarios of why they might do something like that, I gain more compassion for others.”

“I self-reflected on several of the key points and measured myself in my development of compassion. At first, I was not pleased with myself because I was not very compassionate. But, after about weeks of writing about compassion and thinking about how to improve, I found myself feeling more aware of the struggles of those around me and being willing to act to help them reduce their burdens.”

“I have always wanted to be more compassionate, but I have found it difficult to take the first step. I am learning that writing about compassion is the first step. I see myself getting better every week. I am glad I am writing about compassion. I plan to keep writing about it.”

“Compassion is really hard. For a long time, I didn’t understand what it was and the challenges to it. I just found myself getting angry and not knowing how to have a warmer attitude to people. Writing has helped. I am not where I want to be yet with compassion, but I am getting there.”

Participants in the control condition completed the same initial survey as those in the treatment condition. Instead of receiving the compassion training and then journaling about their compassion attitudes and activities, those in the control condition wrote about what their duties and responsibilities were within their class group (where they were preparing a class presentation). They wrote about the details of their assigned tasks, identified any upcoming deadlines and task dependencies, and described any specific processes or procedures they were supposed to follow to complete these tasks the way their class group wanted them to complete them. We also had the participants elaborate as to what they were required to do at home in order to continue to meet their class group’s expectations while away from school. Those in the control condition followed the same process as those in the treatment condition: completing the survey in week one, completing weekly reflective journal entries in weeks two through four, and completing one final journal entry and one final survey in week five.

We administered an online survey to 134 undergraduate students. Of those, 121 participants completed the first survey. Of those, 87 participants completed both surveys and all journal entries during the five-week period. The final sample



was 87 participants ( $n = 44$  in the compassion treatment group and  $n = 43$  in the control group). Participation was voluntary and anonymous. Participants received extra credit for participating in the study. Of the 87 participants, 54% were male and 68% were Caucasian. Average age was 24 years.

We checked the effect of the compassion condition (e.g., a manipulation check) by measuring the participants' final survey scores on the compassion scale (Pommier, Neff, & Tóth-Király, 2020). Illustrative items are as follows: "If I see someone going through a difficult time, I try to be caring toward that person", "I like to be there for others in times of difficulty", and "When others feel sadness, I try to comfort them." We obtained an alpha reliability of .84. We assessed whether the treatment had an effect by comparing post-treatment compassion scores of those in the compassion treatment group with the scores of those in the control group. There were significant post-treatment differences for compassion ( $t(85) = 4.37$ ,  $p < 0.01$ ,  $m_{\text{Treatment Group}} = 4.28$ ,  $s.d. = 0.59$ ,  $m_{\text{Control Group}} = 3.58$ ,  $s.d. = 0.89$ ).

We measured integrating behaviors (other-report) by using the scale developed by Thomas and Kilmann (1974), adapting it to reflect the other-report nature of the data collection. We asked those who worked closely with the participant (those on the same presentation team in same class). Illustrative items are as follows: "In their interactions with others, this person tends to 'Welcome it when others push back and challenge their ideas because this process brings out the best ideas'", "Have clear standards and expectations while also being warm and respectful", and "Be willing to change my mind if faced with a good argument. We obtained an alpha reliability of .86. We measured thriving by using the thriving scale developed by Porath and colleagues (2012). Illustrative items are as follows: "I find myself learning often", "I see myself continually improving", "I feel alive and vital" and "I have energy and spirit." We obtained an alpha reliability of 0.92. As potential control variables, we assessed whether age, race/ethnicity, gender, or GPA were significant control variables. There were no significant controls.

To test the proposed relationship between the compassion treatment group and integrating behaviors (other-report), we compared the post-treatment integrating behaviors means of those in the treatment group with those in the control group. As expected, and in support of hypothesis 1a, the data revealed a significantly higher mean for those in the treatment group: ( $t(85) = 2.35$ ,  $p < 0.05$ ,  $m_{\text{Treatment Group}} = 3.95$ ,  $s.d. = 0.68$ ,  $m_{\text{Control Group}} = 3.59$ ,  $s.d. = 0.76$ ).

To test the proposed relationship between the compassion treatment group and thriving, we compared the post-treatment thriving means of those in the treatment group with those in the control group. As expected, and in support of hypothesis 2a, the data revealed a significantly higher mean for those in the treatment group: ( $t(85) = 3.20$ ,  $p < 0.01$ ,  $m_{\text{Treatment Group}} = 3.23$ ,  $s.d. = 0.62$ ,  $m_{\text{Control Group}} = 2.75$ ,  $s.d. = 0.77$ ).

## **PRIMING COMPASSION (STUDY 2)**

For study 2, we randomly assigned undergraduate students from a university in the Mountain West United States to either the compassion condition (treatment condition) or the control condition. Participants in the treatment condition read a story about compassion based on a scenario we created from Dr. James R. Doty's book, *Into the Magic Shop* (Doty, 2016). This scenario had students imagine they were a young surgeon doing their residency at a prestigious medical institution where they are in their first surgery with their mentor, one of the most well-known surgeons in the country. According to this scenario, as the surgery begins, the medical resident realizes that their nervous anticipation has them sweating more than ever before. And, to their great horror, a drop of their sweat falls from their forehead into the operating site—contaminating the entire procedure. Time stands still as they await the doctor's response—they could be verbally berated, kicked out of the operating room, sent home, or worse. This could affect their entire career trajectory and label them as not having the demeanor and emotional toughness to perform under pressure. Their mind races with dreadful anticipation, but, to their great delight, the doctor responds compassionately, assuring them that, although this is a problem that needs to be avoided in the future, it is a problem that can be fixed. Everything is going to be okay. In fact, in this scenario, after the surgery is finished, the doctor offers further consolation and assurance by recounting a time when he made a similar mistake in his career and how he learned from the experience to have compassion for others who go through difficult things. The doctor elaborates on the importance of compassion (e.g., choosing to build up those in difficult circumstances and helping them feel seen, heard, valued, and understood) and talks about how compassion feels good, inspires, and is deeply connecting. The doctor then assures the medical resident that the compassion they develop from this experience is going to help them go on to have a brilliant and meaningful career. After reading the scenario, students are asked to summarize how the doctor's actions helped make the situation better and write about the positive effects of compassion in their own lives. In contrast, the control condition has students read a dull and monotonous story about a doctor training a medical resident about the details of daily life as a medical resident and of the importance of following rules and getting support as a medical resident.

For study 2, we administered an online survey to 62 undergraduate students (n = 32 in the compassion treatment group and n = 30 in the control group). Participation was voluntary and anonymous. Participants received extra credit for participating in the study. Of the 62 participants, 58% were male and 71% were Caucasian. Average age was 22 years.

Participants in both conditions completed a survey containing questions about compassion, integrating behaviors, and the vitality component of thriving (using the same measures used in study 1, adapting the integrating behaviors measure to reflect self-report and only including the vitality component of the thriving measure): compassion (alpha reliability of .91), integrating behaviors (alpha reliability of .87), and the vitality component of thriving (alpha reliability of .93). As potential control variables, we assessed whether age, race/ethnicity, gender, or GPA were significant control variables. There were no significant controls.

To confirm the study 2 compassion treatment was successful (e.g., manipulation check), we assessed whether the treatment had an effect by comparing post-treatment compassion scores of those in the compassion treatment group with the scores of those in the control group. There were significant post-treatment differences for compassion ( $t(60) = 2.53, p < 0.01, m_{\text{Treatment Group}} = 4.13, s.d. = 0.61, m_{\text{Control Group}} = 3.64, s.d. = 0.87$ ). To test the proposed relationship between the compassion treatment group and integrating behaviors, we compared the post-treatment integrating behaviors means of those in the treatment group with those in the control group. As expected, and in support of hypothesis 1b, the data revealed a significantly higher mean for those in the treatment group: ( $t(60) = 2.17, p < 0.05, m_{\text{Treatment Group}} = 4.02, s.d. = 0.58, m_{\text{Control Group}} = 3.60, s.d. = 0.93$ ). To test the proposed relationship between the compassion treatment group and the vitality component of thriving, we compared the post-treatment vitality component of thriving means of those in the treatment group with those in the control group. As expected, and in support of hypothesis 2b, the data revealed a significantly higher mean for those in the treatment group: ( $t(60) = 4.72, p < 0.01, m_{\text{Treatment Group}} = 3.70, s.d. = 0.87, m_{\text{Control Group}} = 2.63, s.d. = 0.91$ ).

## CONCLUSION

The purpose of this research was to determine the impact of priming compassion in college students. The results are very promising. In fact, we received strong support for all of our hypotheses. We discovered that priming compassion (through writing and through reading a story) has a positive association with integrating behaviors (other-report and self-report) and thriving outcomes (self-report). When students were asked to write about compassion or read a story about compassion, they learned to develop increased levels of compassion. In fact, as a supplemental analysis, we surveyed the study 1 students at the end of their course (over four weeks after the study) to assess the extent to which the enduring prime of writing about compassion had lasting effects. In addition to participating in the study, subsequent class discussions further instilled the value of compassion. As anticipated, those who participated in the writing prime had similar compassion scores as when they completed the study survey (after more than four weeks)—offering some support for the enduring nature of the writing prime. Going forward, we recommend additional research on the longevity of the effects, the other outcomes that priming compassion can predict, and the causal relationship between compassion and integrating behaviors and between compassion and thriving. Our two studies prime compassion and find robust evidence that compassion acts as a predictor of integrating behaviors and thriving, but further studies are warranted wherein, integrating behaviors, for example, are primed as the independent variable and assessed in relationship to compassion as a prospective dependent variable. We also recommend exploring the priming of compassion as a regular graded requirement, perhaps in conjunction with students writing about, and presenting on, crucible moments in their lives that relate to compassion (see Thompson et al., 2019). Moreover, we believe compassion priming may yield profound and meaningful effects in other courses and academic settings as well as private-sector and government organizations, especially if integrated into the broader curriculum of the organization or institution (Liesz & Porter, 2015; Thompson et al., 2019).

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# Puzzles in the College Classroom: An Optimization Model Approach to Martin Gardner's Digit Placing Problem

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## ABSTRACT

Recreational mathematics is fun mathematics. It includes games, riddles, puzzles and magic squares. The purpose of this paper is to present an optimization model approach to one of Gardner's puzzles, "A Digit-Placing Problem," which appears in chapter seven (Eight Problems) in the book *The Unexpected Hanging and Other Mathematical Diversions* (Gardner, 1969, 1991). The approach is to use a fun mathematical approach to learning for students engaged in a quantitative university classroom setting.

**Keywords:** recreational math, modeling optimization, puzzles, spreadsheet, Martin Gardner

## INTRODUCTION

Recreational mathematics includes games, riddles, puzzles and magic squares. Generally, a puzzle is a game or problem designed to test ingenuity or creativity. If it is a math puzzle, it requires mathematical logic and calculation. Math puzzles date back to the Chinese, Greeks and early Egyptians. According to Singmaster (2022), the Chinese Rings puzzle may have originated in China 1800 years ago. Emile Baudot used the solution pattern to the Chinese Rings puzzle in the 1870s to invent the teletype's predecessor. Baudot's measure of transmission speed led to the term "baud." The solution pattern of the Chinese Rings puzzle is the binary coding patented as error-minimizing code by Frank Gray of Bell Labs in 1953. Thus, we can see that mathematics has been intertwined with mathematical games throughout its history. These puzzles are an integral part of the study of mathematics, mainly because such puzzles require mathematical solutions. Such games can range from simple arithmetic or logic puzzles to complex problems, many of which are still unsolved today.

Baywood Publishing publishes a peer-reviewed journal, *The Journal of Recreational Mathematics*, dedicated to this sub-field of mathematics. Some better-known writers include H. E. Dudeney, Sam Loyd, Ed Pegg, Raymond Smullyan and Marilyn vos Savant. Perhaps the most influential individual in the past sixty years is Martin Gardner. Gardner popularized recreational mathematics with his widely read column "Mathematical Games," which appeared in *Scientific American*, from 1956 to 1981. He also authored over 65 books on various topics including mathematics, philosophy, literature and conjuring (Demaine, Demaine, & Rodgers, Eds., 2008). This paper aims to present an optimization model approach to one of Gardner's puzzles, "A Digit-Placing Problem", which appears in chapter seven of the book *The Unexpected Hanging and Other Mathematical Diversions* (Gardner, 1969, 1991).

## LITERATURE REVIEW

The 'Digit Placing Problem,' as with many other mathematical puzzles, is very useful for creative thinking purposes (Anderson, 2014; Zhou, 2019; and Runco, 2010). Another helpful aspect is that mathematical puzzles often require so-called "thinking outside the box" (O'Toole, 2010; Wilton, 2021; Humphrey, 1959; and Tréguer, (2021).

Classroom mathematical games give students the chance to learn fundamental number concepts, such as the counting sequence, one-to-one correspondence, and computation strategies. Mathematical games can also encourage students to explore number combinations, place values, patterns, and other important mathematical concepts and techniques. For various reasons, games are essential for learning in mathematics classrooms. They are involved with 1) encouraging strategic mathematical thinking for solving problems, 2) supporting students' development of computational fluency, and 3) allowing students to develop familiarity with the number system and engage in computation practice.

Fluency requires a connection between conceptual understanding and computational proficiency. Computational methods that are over-practiced without understanding are forgotten or misremembered. Conceptual understanding without fluency can inhibit the problem-solving process. Developing computational fluency is an expectation of the common core standards for Mathematics. The research about how students develop mastery indicates that drill

techniques and timed tests have little power that mathematical games and other experiences have (Randel, Morris, Wetzel, & Whitehill, 1992). Appropriate mathematical activities are essential for developing mathematically proficient students who demonstrate computational fluency.

Traditional mathematics teaching in schools tends to foster memorization of facts and procedures, but math games are an effective pedagogical tool to enhance learning. Studies indicate that most students need help learning mathematics due to little encouragement for self-learning, lack of interest and proficiency in the subject, and lack of continuity and focus (Battista, 1999).

The effect of students' lack of active achievement and participation in math assessment is a profoundly troublesome problem. Teachers at all grade levels are increasingly turning to use of mathematical games to engage students in math problems (Ahmad et al., 2009). The effectiveness of games as a classroom tool requires further examination of whether games can teach mathematical concepts. Although there is much prior research supporting the benefits of digital games in the classroom, there is mixed empirical support. This research report provides an overview of the theoretical and empirical evidence behind the use.

Traditional mathematics teaching, which is still the norm in schools, is an endless sequence of memorizing and forgetting facts and procedures" (Battista, 1999). Traditional mathematics instruction follows the same daily routine, including guided and independent practice (Battista, 1999). Thus, there is a dire need for teachers to make the learning of mathematics meaningful in order to motivate students to learn and study mathematics.

Ahmad et al. (2009) found that most students need help learning mathematics due to little encouragement for self-learning and a lack of continuity and focus. Taylor (2010), while studying the causes of low math achievement of students of the United States compared to students of other countries, found the following two reasons: Students are becoming less interested in mathematics, and they lack proficiency in mathematics. He maintained that mathematics is a core skill necessary to live and work in society. Khan and Chishti (2011), in an attempt to study whether students' active participation affected math achievement, found that students' active participation in mathematics class played a tremendous role in their math achievement.

Recent studies conducted to study the effectiveness of math games in learning provide us the motivation to use games including computer games in learning mathematics especially at the primary level (Clark and Ernst, 2009; Huizenga, Admiral, Akkerman, & Dam, 2009). In order to help close the gaps between high and low-achieving students, it is essential to consider methods that could provide techniques to enhance learning. For several decades, many stakeholders have highlighted the importance of digital technologies in mathematics education.

The U.S. National Council of Teachers of Mathematics, for example, in its position statement, claims that "Technology is an essential tool for learning mathematics in the 21st century, and all schools must ensure that all their students have access to technology" (NCTM, 2008). Their research asserts that mathematical games, puzzles, and stories involving numbers help children connect the dots between the logical functioning of their everyday lives to that of mathematical thinking and build upon their everyday understandings. Games provide feedback to the child with minimal teacher intervention.

As previously noted, gaming in the mathematics classroom has many potential benefits. Mathematics games are essential to increase engagement, motivation, and student learning (Clark & Ernst, 2009; Huizenga, Admiral, Akkerman, & Dam, 2009). Students using games get immense opportunities for content application in real-life settings, followed by positive encouragement or corrective feedback (Allsopp et al., 2007). Incorporating games could help teachers plan to fulfill the learning objectives of problem-based mathematics lessons (Van de Walle, Karp, & Bay-Williams, 2010).

There is ample research evidence on the effects of electronic games on learning, including video and computer games, game-based simulations, and quiz-type games (Afari, Aldridge & Fraser, 2012). Arbaugh et al. (2008) stressed the need to improve mathematics education in American schools and improve students' learning. They also stated that maximizing the use of technology in schools and classrooms could help to improve student learning. "Mathematical technologies allow the user to operate on mathematical entities . . . [and] provide people with a range of mathematical activities and forms of mathematical representations" (Arbaugh et al., 2008, p. 20).

Arbaugh et al. continued, "Collaborative and communicative technologies allow users to create, manipulate, edit, communicate, and share experiences, ideas, and products using words, numbers, symbols, images, audio, and video" (p. 20). Twigg (2011) maintained the need for integrating technology into mathematics curricula because technology is necessary for student learning in society. According to Twigg (2011), interactive software and computers are the keys to helping students learn math by doing.

Hamilton (2007) reported that incorporating technology correlated with improved student mathematics achievement. Rosen & Beck-Hill (2012) found that educational technology is an essential means of closing the achievement gap and aids in incorporating higher-order thinking skills.

Since 2010, tablet computers like the iPad have been the most recent and popular handheld game-based learning devices (Buckley, 2010; Castelluccio, 2010; Hill, 2011; Murphy, 2011; Price, 2011; Stevens, 2011). According to Mansour & El-Said (2009), game-based learning as an educational tool is still in its infancy. Griffin (2007) suggested that math teachers connect examples to the real world through interactive games. Elementary students typically enjoyed educational games and were excited and interested in math while playing them.

Recent researchers have questioned the way games are used in teaching mathematics. Given the significant uptake of Interactive Whiteboards, and computer and electronic games, it is time for research on using games in mathematics teaching to be re-examined. There is little clear research evidence about how to derive effective mathematics learning from a game. Games have rarely been reported as being used as the basis of a lesson or to encourage discussion of a mathematical concept. There needs to be more evidence as to how math games are being used in teaching mathematics, and the legitimacy of this approach still needs to be established.

### **ROLE OF MATHEMATICAL GAMES AND STEM LEARNING**

According to psychologist Susan Levine, puzzle play is an easy way for teachers to enhance students' spatial and math learning. Puzzles allow young children to explore key math concepts like shapes, sizes, and how and where one puzzle piece fits another. These spatial skills support children's understanding and have been shown to predict children's success in the STEM disciplines.

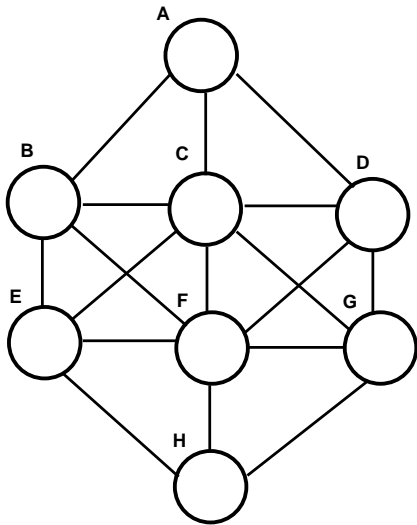
Levine and her colleagues at the University of Chicago conducted a study that found 2-4-year-old children who play with puzzles have better spatial skills. After controlling for differences in parents' income, education, and the overall amount of parent language input, researchers say puzzle play was a significant predictor of spatial skills.

Improvements in math education are also a point of emphasis for the National Science Foundation, which partly funded the study. "This study brings greater awareness of the learning opportunities for children in everyday activities," said Soo-Siang Lim, program director for the NSF's Science of Learning Centers Program. "It is important because this and follow-up studies could potentially lead to relatively easy and inexpensive interventions to improve spatial skills important for STEM education."

### **GARDNER'S DIGIT-PLACING PROBLEM**

The following is Gardner's description of the digit-placing puzzle problem and model as well as the exact solution applied in a modern Microsoft Excel Solver that could efficiently be utilized in an appropriate university classroom setting:

"This perplexing Digital Problem, inventor unknown, was passed on to me by L Vosburgh Lyons of New York City. The digits from 1 to 8 are to be placed in the eight circles shown in Figure 31, with this proviso: no two digits directly adjacent to each other in serial order may go in circles that are directly connected by a line. For example, if 5 is placed in the top circle neither 4 nor 6 may be placed in any of the three circles that form a horizontal row beneath it because each of these circles is joined directly to the top circle by a straight line. There is only one solution (not counting a rotation or mirror reflection as being different), but if you try to find it without a logical procedure, the task will be difficult." (Gardner, 1969, 1991).



### The Digit-Placing Problem as a Mathematical Model

The initial step in model development is to state the Digit-Placing Problem as a mathematical model. We will use the letters A-H, as displayed in the figure on the previous page, for the eight circles. In the model there does not exist an objective as one would normally find in an optimization model. The constraints will be sufficient for model formulation.

Constraints:

$A, B, C, D, E, F, G, H = \text{integer}$

$A, B, C, D, E, F, G, H \geq 1$

$A, B, C, D, E, F, G, H \leq 8$

$A, B, C, D, E, F, G, H = \text{all different}$

$ A-B $	$\geq 2$
$A-C$	$\geq 2$
$A-D$	$\geq 2$
$B-C$	$\geq 2$
$B-F$	$\geq 2$
$B-E$	$\geq 2$
$C-D$	$\geq 2$
$C-E$	$\geq 2$
$C-F$	$\geq 2$
$C-G$	$\geq 2$
$D-F$	$\geq 2$
$D-G$	$\geq 2$
$E-F$	$\geq 2$
$E-H$	$\geq 2$
$F-G$	$\geq 2$
$F-H$	$\geq 2$
$G-H$	$\geq 2$

### DIGIT-PLACING PROBLEM AS A SOLVER SPREADSHEET

Microsoft Excel Solver is utilized to formulate and solve the model. Solver is an add-in tool for the standard Microsoft Excel. It was developed by Frontline Systems, a leading optimization software developer (Frontline, 2011a; 2011b). The initial spreadsheet formulation is displayed in Table 1. The formula view of the spreadsheet model is displayed in Table 2. The Solver parameters for the model are displayed in Figure 1. The final solution spreadsheet is displayed in Table 3. A graphical display of the solution is displayed in Figure 2.

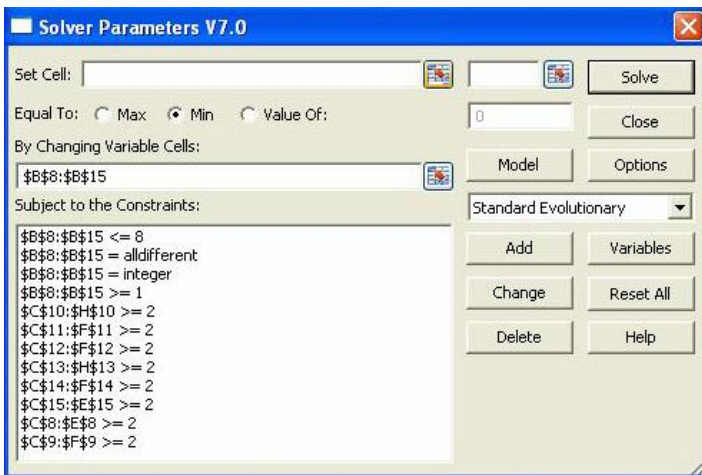
**Table 1: Initial Excel Solver Formulation Digit-Placing Problem**

1/A	B	C	D	E	F	G	H
2							
3			1				
4		2	3	4			
5		5	6	7			
6			8				
7	Int.						
8	1	1	2	3			
9	2	1	1	4	3		
10	3	2	1	2	3	4	1
11	4	3	1	2	3		
12	5	3	2	1	3		
13	6	3	4	1	2	1	2
14	7	3	4	1	1		
15	8	3	2	1			

**Table 2: Formula View Excel Solver Digit-Placing Problem**

1/A	B	C	D	E	F	G	H
2							
3			=B8				
4	=B9		=B10	=B11			
5	=B12		=B13	=B14			
6			=B15				
7	Int.						
8	7	=ABS(B8-B9)	=ABS(B8-B10)	=ABS(B8-B11)			
9	3	=ABS(B9-B8)	=ABS(B9-B10)	=ABS(B9-B13)	=ABS(B9-B12)		
10	1	=ABS(B10-B8)	=ABS(B10-B9)	=ABS(B10-B12)	=ABS(B10-B13)	=ABS(B10-B14)	=ABS(B10-B11)
11	4	=ABS(B11-B8)	=ABS(B11-B10)	=ABS(B11-B13)	=ABS(B11-B14)		
12	5	=ABS(B12-B9)	=ABS(B12-B10)	=ABS(B12-B13)	=ABS(B12-B15)		
13	8	=ABS(B13-B10)	=ABS(B13-B9)	=ABS(B13-B12)	=ABS(B13-B15)	=ABS(B13-B14)	=ABS(B13-B11)
14	6	=ABS(B14-B11)	=ABS(B14-B10)	=ABS(B14-B13)	=ABS(B14-B15)		
15	2	=ABS(B15-B12)	=ABS(B15-B13)	=ABS(B15-B14)			

**Figure 1: Excel Solver Parameters Digit-Placing Problem**

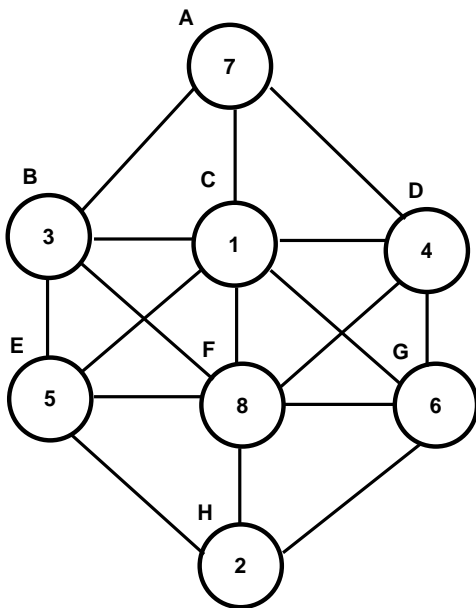




**Table 3: Excel Solver Solution Digit-Placing Problem**

1/A	B	C	D	E	F	G	H
2							
3			7				
4		3	1	4			
5		5	8	6			
6			2				
7	Int.						
8	7	4	6	3			
9	3	4	2	5	2		
10	1	6	2	4	7	5	3
11	4	3	3	4	2		
12	5	2	4	3	3		
13	8	7	5	3	6	2	4
14	6	2	5	2	4		
15	2	3	6	4			

**Figure 2: Graphical Display Solution Digit-Placing Problem**



**Summary**

Martin Gardner wrote the column "Mathematical Games" in Scientific American for twenty-five years. The puzzles in this publication significantly contributed to the popularity of recreational mathematics. His 1969 book *The Unexpected Hanging and Other Mathematical Diversions* is a famous collection of mathematical problems and riddles. One of the puzzles, "A Digit-Placing Problem," is an excellent example of a riddle that can be formulated as a mathematical model. This paper presents the mathematical model, the spreadsheet formulation, and the spreadsheet solution of this puzzle.

The use of this puzzle and other puzzles in classroom learning versus memorization drills reflects on the current literature that supports puzzles as a fun college or university classroom technique that improves students spatial, math and technical learning.

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# Teaching Business Analytics Students Logistic Regression Using Python and R

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## ABSTRACT

This article discusses challenges and surprising computational results from teaching business analytics students logistic regression using Python in a predictive analytics course. One solution is to incorporate both Python and R in such courses so students can learn both open-source tools in the same course. An exercise is provided to have students compare the results from Python and R. The experience and technical details shared in this article should be valuable to other instructors teaching this topic using Python or R in similar courses to help students obtain accurate computational results.

**Keywords:** business analytics, logistic regression, open-source software, predictive analytics

## INTRODUCTION

The Institute for Operations Research and the Management Sciences (INFORMS) proposed three levels of business analytics: descriptive, predictive, prescriptive. Predictive analytics focuses on predicting what will happen applying statistics, data mining, and machine learning methods (Sharda et al., 2020). R or Python is usually the preferred open-source tool in predictive analytics courses and R has been incorporated into popular business analytics textbooks such as James et al. (2021) and Taddy et al. (2023). R, originated in statistics, contains a comprehensive collection of packages covering statistical analysis and data visualization. Python is a very popular general-purpose programming language with a large collection of libraries including NumPy, Pandas, scikit-learn, Keras, and TensorFlow for data science, machine learning, and deep learning. Python is gaining popularity in business schools (see Brau et al., 2020; Frydenberg and Xu, 2019; Harnowo, 2022; Li, 2022; Sharp, 2019). Sharp (2019) and Harnowo (2022) have developed innovative approaches to help business students learn Python by incorporating external learning platforms into their courses.

Recent surprising discoveries by the author that Python may not produce accurate results for logistic regression in a predictive analytics course led the author to deploy both Python and R in the same course. Given the popularity of these two programming languages in analytics and data science as evidenced in analytics job postings, teaching both languages in predictive analytics courses is desirable. Both languages have strengths and weaknesses suitable for different tasks. This article documents the author's surprising discoveries and shares the author's approach to teaching business analytics students logistic regression using both Python and R. The author hopes sharing this experience will start a conversation among colleagues about best practices to deploy these open-source tools in the business analytics curriculum.

## TEACHING LOGISTIC REGRESSION USING PYTHON'S SCIKIT-LEARN LIBRARY

Logistic regression is a critical topic in predictive analytics courses with course names such as data mining or machine learning. It is one of the most important supervised learning methods for classification. The author teaches this topic in both undergraduate and graduate predictive analytics courses following the textbook and Python example code by Shmueli et al. (2020). However, after completing the first logistic regression assignment, some of the author's students reported that they were confused by the different results they produced using the same data and Python code when these students compared their results. The author then assigned a discussion assignment in canvas to let all students see how the results differ.

Execute the Python code from Table 10.2 of the textbook (Shmueli et al., 2020) on your computer and post the logistic regression output here in Discussion. In your post, indicate the type of computer (PC, Mac, Surface, etc.), the processor (Intel, Apple, AMD, etc.), and the operating system (Windows, MacOS, Linux, etc.) you used to produce these results. Do the results you got match the output in Table 10.2? Do the results you got match those posted in Discussion by other students?

Table 10.2 of Shmueli et al. (2020) contains the example code and output fitting logistic regression to the Universal Bank data (<https://github.com/gedeck/dmba/blob/master/datasets/dmba-datasets.zip>) of 5000 bank customers with the `LogisticRegression(penalty='l2', C=1e42, solver='liblinear')` function from Python's scikit-learn machine learning library. The outcome variable is whether a customer accepted a personal loan offered in the last target marketing campaign. The predictors include customer demographic information (age, education level, income, etc.) and their relationships with the bank (the value of house mortgage, whether the customer has a securities account, a credit card, a certificate of deposit account with the bank, etc.). When comparing the posted results to answer these questions in discussion, students were intrigued by the comparison! What surprised students was that those who did not use a Mac with an Intel processor produced different logistic regression intercepts and coefficients from those in Table 10.2 of Shmueli et al. (2020) when executing the same Python example code. The posted results as summarized in Table 1 show that only the same type of computers produced the same intercept and coefficients.

**Table 1 Coefficients and AIC from the same logistic regression code on four types of computers**

Coefficients	Mac with Intel Processor	Mac with M1 Processor	PC with AMD Ryzen Processor	PC with Intel Processor
Intercept	-12.61895521314	-12.581450843608	-12.494999862875	-12.10519400658
Age	-0.032549	-0.034624	-0.037616	-0.051667
Experience	0.03416	0.03619	0.039133	0.052952
Income	0.058824	0.058894	0.058844	0.058676
Family	0.614095	0.612874	0.612264	0.609565
Credit Card Spending	0.240534	0.240588	0.240487	0.240421
Mortgage	0.001012	0.001013	0.001012	0.00101
Securities Account	-1.026191	-1.019702	-1.01417	-1.030108
CD Account	3.647933	3.655724	3.649094	3.648152
Internet Banking	-0.677862	-0.677556	-0.678414	-0.678944
Credit Card	-0.95598	-0.958711	-0.958456	-0.961048
Graduate Degree	4.192204	4.204775	4.201983	4.19873
Advanced/Professional Degree	4.341697	4.356221	4.355611	4.358777
AIC	-709.1524769206	-733.9975169177	-709.1524769206	-709.15247692

Except Mac with an M1 processor, the other three types of computers produced the same AIC (Akaike Information Criterion). The coefficients in Table 1 quantify the roles played by predictors and their exponentiation has practical meanings in terms of odds, e.g.,  $e^{4.192204}$  or around 66 is the odds that a customer with a graduate degree will accept the loan offer relative to a customer with an undergraduate degree when holding the other predictors constant. A slight difference in these coefficients as shown in Table 1 may lead to a significant difference in terms of odds from exponentiating these coefficients.

To understand these discrepancies, the author explains to the students the importance of understanding the documentation for scikit-learn's `LogisticRegression()` function ([https://scikit-learn.org/stable/modules/generated/sklearn.linear\\_model.LogisticRegression.html](https://scikit-learn.org/stable/modules/generated/sklearn.linear_model.LogisticRegression.html)). Major findings from reviewing this documentation are summarized below:

(a) The function implements regularized logistic regression with the “liblinear” library and other solvers: “lbfgs”, “newton-cg”, “newton-cholesky”, “sag”, “saga”. The default solver is “lbfgs”, a quasi-Newton method approximating the Broyden–Fletcher–Goldfarb–Shanno algorithm (BFGS) but using a limited amount of computer memory. Other solvers including “liblinear”, “newton-cg”, “newton-cholesky”, “sag”, and “saga” can be chosen depending on the size of the data, the number of classes, and other characteristics. The solver “liblinear” used here is a popular open-source machine learning library implementing a coordinate descent algorithm. It is a linear classifier for data with millions of observations and predictors.

(b) Since the function fits regularized logistic regression, regularization is applied by default and the default penalty is L2 (ridge regression). The computational algorithm for regularized logistic regression is somewhat different from

the maximum likelihood method implemented in traditional statistical software such as R, SAS, etc. Regularization is not needed in many applications. To obtain unregularized logistic regression using the `LogisticRegression()` function in scikit-learn, either set the parameter “penalty” to “none” or with the L2 penalty force the inverse of regularization strength “C” to a very large number. No regularization can be applied by setting the penalty parameter to “none” for the solvers “lbfgs”, “newton-cg”, “newton-cholesky”, “sag”, and “saga”. However, the “liblinear” library used here has only two types of penalty “L1” and “L2” available to choose from without the option of setting the penalty parameter to “none”. Therefore, the parameter “C” in the `LogisticFunction()` needs to be set to a large number, e.g.,  $C=1e42$ , to avoid regularization as in the code to obtain the results in Table 1.

(c) A note in the documentation offers the clue to the different coefficients in Table 1: “The underlying C implementation uses a random number generator to select features when fitting the model. It is thus not uncommon, to have slightly different results for the same input data. If that happens, try with a smaller tol parameter.” The default value for the “tol” parameter is  $1e-4$ . The instructor assigns another discussion assignment by adding “tol= $1e-8$ ” to the parameters of the `LogisticRegression()` function in the first discussion assignment and all students produced the same coefficients up to four decimal places and AIC:

**Table 2 Coefficients and AIC with “tol= $1e-8$ ”**

Coefficients	tol = $1e-8$
Intercept	-12.5634
Age	-0.0354
Experience	0.0369
Income	0.0589
Family	0.6128
Credit Card Spending	0.2408
Mortgage	0.0010
Securities Account	-1.0305
CD Account	3.6628
Internet Banking	-0.6794
Credit Card	-0.9609
Graduate Degree	4.2075
Advanced/Professional Degree	4.3580
AIC	-733.9975169177105

Thus this “tol” parameter needs to be set carefully to obtain the same coefficients on different types of computers. However, having to adjust the default tolerance level of  $1e-4$  for the liblinear function every time does not appear to be reasonable. The user may not be certain about what tolerance level to choose, as argued by the author’s students. Moreover, these coefficients do not match any of the four columns in Table 1 with the default tolerance level of  $1e-4$  or those in Table 10.2 of the textbook (Shmueli et al., 2020). These coefficients in Table 2 actually match those produced using the `glm` (Generalized Linear Models) method in another Python package called `statsmodels` or using the `glm()` function in R. The Python package `statsmodels`, designed for statistical analysis, follows similar syntax in R. The `glm` method in both `statsmodels` and R implements the traditional Iteratively Reweighted Least Squares (IRLS) algorithm and produces the same intercept and coefficients as in Table 2.

(d) The default solver “lbfgs” described in (a) allows the “penalty” parameter (see discussion in (b)) in the `LogisticRegression()` function to be set to “none” for regular logistic regression without regularization. When fitting the `LogisticRegression(penalty='l2', C=1e42, solver='liblinear')` function for Table 1, the solver used for the results in Table 1 is “liblinear”, not the default solver “lbfgs”. A further investigation into applying this default solver “lbfgs” with appropriate settings including the tolerance level, no penalty, and the number of maximum iterations: `LogisticRegression(penalty='none', solver='lbfgs', tol=1e-8, max_iter=10000)`, shows more surprising findings. The intercepts and coefficients obtained by the author and his students are completely different from those in Table 1 or Table 2. Moreover, the intercepts and coefficients from the same type of computers as listed in Table 1 do not all match! For example, results from one PC with an AMD Ryzen 7 processor match those from another PC with an

AMD Ryzen 9 processor but do not match those from a third PC with an AMD Ryzen 7 processor. Therefore, this default solver “lbfgs” does not seem to produce accurate results. This is both surprising and concerning.

The discussion so far shows that care must be taken to apply Python’s scikit-learn machine learning library for logistic regression correctly. The author’s experience is that the instructor needs to explain in class different solvers and parameter options available for the LogisticRegression() function and theoretical aspects of Generalized Linear Models for the sm.glm method in the Python library statsmodels so students can apply these functions correctly to fit logistic regression. Moreover, explaining different solvers and parameter options requires an explanation of technical concepts including maximum likelihood estimation, Newton’s method and its variations, stochastic gradient descent, regularization (lasso and ridge regression), etc. These are challenging concepts for business analytics students who may not have the statistical knowledge and mathematical skills that statistics majors possess. The instructor must find the right balance between intuition and technical details covering enough technical content in a reasonable amount of time to enable business analytics students to apply these functions correctly.

## TEACHING ADVANCED LOGISTIC REGRESSION USING PYTHON’S SCIKIT-LEARN LIBRARY AND R’S GLMNET

The LogisticRegression() function in Python’s scikit-learn library includes the “elasticnet” penalty combining the L1 (lasso) and L2 (ridge regression) penalty terms. To choose the hyperparameter (C) for the L1 or L2 penalty term, the LogisticRegressionCV() function ([https://scikit-learn.org/stable/modules/generated/sklearn.linear\\_model.LogisticRegressionCV.html](https://scikit-learn.org/stable/modules/generated/sklearn.linear_model.LogisticRegressionCV.html)) with very similar options and syntax to the LogisticRegression() function should be used to select the appropriate regularization strength (1/C) via cross validation. The “elasticnet” penalty requires selecting an additional weight, i.e., another hyperparameter, called “l1\_ratios” in LogisticRegressionCV() (or “l1\_ratio” in LogisticRegression()), with “l1\_ratios” representing the weight for the L1 penalty term and (1- “l1\_ratios”) representing the weight for the L2 penalty term.

The author and his students have had difficulties finding good examples or tutorials to implement the code to select “l1\_ratios” for the “elasticnet” penalty. The scikit-learn documentation does not include such an example. Machine learning textbooks using Python (Chollet 2021, Fenner 2020, Geron 2019, Tan et al. 2019, Unpingco 2019) do not contain Python examples illustrating how to select “l1\_ratios”. Moreover, the “elasticnet” implementation in Python does not appear to be the most up to date. On the other hand, the algorithm for the elastic-net regularized Generalized Linear Models (see Friedman et al., 2010) is implemented in an up-to-date R library called glmnet, with detailed documentation and examples hosted at [glmnet.stanford.edu](http://glmnet.stanford.edu). This R library allows easy and quick implementation of a large class of regularized Generalized Linear Models including all models discussed. The author had his students complete the following exercise using the email spam data in Taddy et al. (2023):

The training data spam.csv (<https://github.com/TaddyLab/MBA/blob/main/1regression/Spam.csv>) contains 4601 emails and 57 email features (predictors) including indicators for the presence of 54 keywords or characters (e.g., free or \$), counts for capitalized letters (the total number and longest continuous block length), and a numeric spam variable (outcome) for whether each email has been tagged as spam by a human reader (spam is 1 for true spam, 0 for important emails). Build a filter for email spam - junk mail that can be ignored. Every time an email arrives, your email client performs a binary classification: is this *spam* or *not spam*? The email that is classified as spam gets automatically moved to a spam folder, keeping your inbox free for important messages. Train your own spam filter by fitting the following logistic regression models:

- (1) Fit an automated feature selection method by using regularization with the L1 penalty (lasso) through the LogisticRegressionCV() function from Python’s scikit-learn library. Set the number of folds to the default value 10, i.e., cv=10. Include the following options: random\_state=1, tol=1e-8, max\_iter=10000. Provide Python code and the output.
- (2) Report the value of the penalty parameter C.
- (3) Convert C to the more common notation lambda indicating regularization strength used for the lasso (L1) model as in R’s glmnet and report the value of lambda.
- (4) How many features are automatically selected by the L1 penalty (lasso)? List the features that are not selected by lasso.
- (5) Besides automatic feature selection, what is the main reason for using regularization with the L1 penalty (lasso)?
- (6) Use R’s glmnet() to fit both lasso (L1) and elastic-net models to this dataset. Compare the predictors

selected from both to those predictors selected in (4). Make sure you execute `set.seed(123)` at the beginning of your R code once every time you execute your R code so the results can be reproduced using the same random numbers. Since this is the training dataset, do not partition the data when fitting the models. Answer the following questions:

- How many features are automatically selected by lasso using R's `glmnet()`? List the features that are not selected.
- How many features are automatically selected by the elastic-net model using R's `glmnet()`? List the features that are not selected.
- What is the chosen value of alpha (alpha is the weight for the L1 penalty term and (1-alpha) is the weight for the L2 penalty term) from the elastic-net model? Is it more lasso (L1) or ridge (L2)? Explain briefly.

The Python and R code to produce the answers for this exercise are provided in the Appendix. Table 3 summarizes the findings by fitting lasso (L1) and Elastic-Net models. The Elastic-Net model is fitted using R's `glmnet`. Lasso (L1) is fitted using the `LogisticRegressionCV()` function in `scikit-learn` and R's `glmnet`.

**Table 3 Features not Selected and Regularization Strength from Three Fitted Models**

Features Not Selected	L1 using Python Scikit-Learn's <code>LogisticRegressionCV()</code>	L1 using R's <code>glmnet</code>	Elastic-Net using R's <code>glmnet</code>
word_415		x	x
word_857	x		
word_direct			x
word_table	x	x	x
capital_run_length_averag	x	x	
Regularization Strength	2.7825594	0.000700902	20% L1 and 80% L2

Predictors need to be standardized first for lasso (L1) when using the `LogisticRegressionCV()` function. Only three features (predictors) are dropped and 54 features are automatically selected by these three models. The feature (predictor) "word\_table" is dropped from all three models but the other features are not all dropped depending on the fitted model. The parameter estimates indicating regularization strength for lasso (L1) are different. There is little regularization strength (0.000700902) for lasso (L1) from R's `glmnet` compared with the estimate (2.7825594) from `scikit-learn`'s `LogisticRegressionCV()`. The Elastic-Net model using R's `glmnet` indicates a combination of 20% lasso (L1) and 80% ridge regression (L2). Students compare the different results from Python's `scikit-learn` and R's `glmnet` and understand that results from Python and R may not match.

## CONCLUSIONS

A surprising discovery of differences in computational results using the `liblinear` solver in the `LogisticRegression()` function from Python's `scikit-learn` machine learning library on different types of computers illustrates the importance of explaining the `scikit-learn` documentation in predictive analytics courses, especially when none of the machine learning textbooks using Python discuss fitting logistic regression using these libraries in detail. Moreover, the default solver "lbfgs" with an adjusted tolerance level of  $1e-8$  for maximum accuracy still produces inaccurate results compared with those from traditional statistical software. Care must be taken to ensure that the logistic regression results are accurate for business data of ordinary size, e.g., a few thousand observations, so business decisions can be made based on the most accurate numerical results. The `scikit-learn` "liblinear" library, a popular open-source linear classifier designed for data with millions of observations and features, can produce accurate results with a carefully chosen tolerance level for accuracy. For common business data not involving millions of observations or predictors, the author recommends the Python module `statsmodels` or R for unregularized logistic regression. For regularized logistic regression such as the elastic-net model combining both the L1 and L2 penalty terms, the author recommends R's `glmnet` developed by the inventors of the elastic-net model. From the author's experience teaching deep learning in his predictive analytics courses, Python and the associated machine learning libraries such as `scikit-learn` and TensorFlow are a good choice for large-scale machine learning problems. `Scikit-learn` is a machine learning library for Python. TensorFlow, developed by Google primarily for deep learning applications, is another Python library for machine learning and artificial intelligence.

This is the author's first attempt to document some of the surprises discovered when teaching predictive analytics courses using Python. When teaching other topics in predictive analytics courses, the author has also noticed that Python and R produce different results for other methods such as Classification and Regression Trees, discriminant analysis, neural networks, etc. Further research is warranted to understand these differences. R appears to produce more accurate results. Business analytics students need to be introduced to both Python and R in predictive analytics courses so they can choose appropriate functions from both tools for different types of problems. One tool may be better for one type of problem than the other. One size does not fit all.

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## APPENDIX: PYTHON AND R CODE FOR THE EXERCISE

### Python Code

```
spam_df = pd.read_csv('Spam.csv')
y = spam_df['spam']
X = spam_df.drop(columns=['spam'])
# Standardize the data
from sklearn.preprocessing import StandardScaler
# Initiate scaler
sc = StandardScaler()
# Standardize the training dataset
X_train_transformed = pd.DataFrame(sc.fit_transform(X),index=X.index, columns=X.columns)
# Standardized the testing dataset
# X_valid_transformed = pd.DataFrame(sc.transform(valid_X),index=valid_X.index, columns=valid_X.columns)
logit_red = LogisticRegressionCV(penalty="l1", solver='liblinear', cv=10, random_state=1, tol=1e-8, max_iter=10000)
logit_red.fit(X_train_transformed, y)
pd.set_option('display.width', 95)
pd.set_option('display.precision',4)
pd.set_option('display.max_columns', 60)
print('regularization', logit_red.C_)
print('intercept ', logit_red.intercept_[0])
print(pd.DataFrame({'coeff': logit_red.coef_[0]}, index=X.columns).transpose())
pd.reset_option('display.width')
print('AIC', AIC_score(y, logit_red.predict(X), df=len(X.columns) + 1))
pd.reset_option('display.width')
pd.reset_option('display.precision')
```



```
pd.reset_option('display.max_columns')
logit_red.C_
# lambda=1/C
1/logit_red.C_
```

#### **R Code**

```
spam_df <- read.csv("Spam.csv")
y <- spam_df$spam
# creating a matrix with predictors
X <- model.matrix(spam ~ ., spam_df)[, -1] #remove intercept as glmnet will add intercept
library(glmnet)
# lasso L1
# Find the best lambda using cross-validation
set.seed(123)
cv.lasso <- cv.glmnet(X, y, alpha = 1, family = "binomial")
cv.lasso$lambda.min
1/cv.lasso$lambda.min
# Fit the final model on the training data
model <- glmnet(X, y, alpha = 1, family = "binomial",
               lambda = cv.lasso$lambda.min)
# Display coefficients
coef(model)
# ELASTIC NET WITH  $0 < \text{ALPHA} < 1$ 
a <- seq(0.1, 0.9, 0.05)
library(foreach)
library(parallel)
search <- foreach(i = a, .combine = rbind) %dopar% {
  cv <- cv.glmnet(X, y, family = "binomial", nfold = 10, type.measure = "deviance", parallel = TRUE,
                alpha = i)
  data.frame(cvm = cv$cvm[cv$lambda == cv$lambda.1se], lambda.1se = cv$lambda.1se, alpha = i)
}
cv3 <- search[search$cvm == min(search$cvm), ]
cv3
md3 <- glmnet(X, y, family = "binomial", lambda = cv3$lambda.1se, alpha = cv3$alpha)
coef(md3)
```

# Remote Teaching Methods that Drive Student Engagement and Institutional Promotion

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## ABSTRACT

The historic shift to remote learning that occurred over the past three years has enabled changes in course delivery in higher education that may have otherwise taken years to come to fruition. In this study remote teaching methods were identified by student focus groups and investigated through survey research connecting specific teaching methods, student motivation, student cheating with student engagement and institutional promotion as measured by the Net Promoter Score (NPS). Data show that the human factor in teaching is indeed a significant predictor of student engagement and institutional promotion. The critical issue of student cheating and poor motivation that are inherent to remote learning are shown to have a detrimental effect on student engagement.

**Key words:** Remote teaching, NPS, student engagement, cheating

## INTRODUCTION

Remote teaching has been a growing trend in higher education for the last twenty years, recent necessity has forced all higher education institutions to adapt fast to technology and student needs. This historic shift has enabled changes in delivery that may have taken years to come to fruition. McKinsey & Company reports that from 2012 – 2019 hybrid and remote delivery of higher education courses increased by 36%, this accelerated to an additional increase of 92% due to COVID (Diaz-Infante, Lazar, Ram, & Ray, 2022). This growth continued in online degree-granting institutions with the largest online degree institutions reporting an average increase in enrollment of 11% while total enrollment fell by 3% from 2019-2020 (Diaz-Infante, Lazar, Ram, & Ray, 2022).

Remote teaching methods use “one or more technologies to deliver instruction to students who are separated from the instructor” (Seaman, Allen, & Seaman, 2018, p. 5). These technologies enable flexibility in delivery, consumption of information, collaboration, and information sharing. Negative effects of remote teaching methods include academic dishonesty, and reduced human connection in terms of communication and interaction (Arkorful & Abaidoo, 2015). Advances in artificial intelligence such as ChatGPT (Illingworth, 2023) and the availability of test banks, exams, quizzes, class notes, cases and videos provide resources that enable academic dishonesty.

Institutions must now identify how the changes in delivery have affected student engagement in the learning process and how student engagement affects the institutional brand. The central premise of this research is that specific remote teaching methods, poor student motivation, and student cheating may affect student engagement in their own learning and in the institution. This engagement drives student promotion of the institution.

## PREVIOUS RESEARCH

### Remote teaching methods

Differentiating teaching methods that foster student engagement is a process that must pivot from the traditional face-to-face classroom to remote technology-enabled delivery. A framework for understanding the educational techniques that facilitate student engagement was developed by Chickering and Ehrmann in 1996. This framework has become a referent model for best practices in online course delivery and instruction (Bangert, 2004). Key themes in this model are collaboration, engagement, and differentiation with seven principles of course design. These principles are faculty-student communication and collaboration, student-student communication and collaboration; active learning techniques; prompt feedback; appropriate time for tasks; high-performance expectations, and respect for diverse learning styles (Tanis, 2020, p. 2). Fundamental to this framework is the development of a safe learning environment that is built on communication and trust (Mayne & Wu, 2011). Students are engaged when they feel a sense of social presence and a connection to faculty and peers (Plante & Asselin, 2014). Collaboration in the online class should encourage students to investigate content as a group of learners within and outside of the class (Palloff & Pratt, 2007).

Faculty to student communication and collaboration should be structured to provide information about the course, faculty expectations, and faculty personal information as it relates to course content and expertise. Tools such as email, personal introductions, photos, short videos, biographies enable faculty and students to meet each other in the

course (Jones & et al., 2009). Ice breakers, online chats, discussion boards, and videos provide visual connections between faculty and students (Martin & Bollinger, 2018). Student outcomes related to faculty communication and specific feedback include student motivation, course satisfaction (Dahalan & et al., 2013). Best faculty practices include providing individual student feedback throughout every stage of the course (Lewis & Abdul-Hamid, 2006). Lewis & Abdul-Hamid (2006) found that timely faculty communication with students is related to positive university connections.

Communication and collaboration in the remote environment should support student-to-student connections. Engaged students share experiences, resources, and ideas to develop a class community of learning (Bollinger & Martin, 2018). Techniques that encourage student-to-student communication include student-generated discussions, audio, and video submissions (Gedik, Kiraz, & Ozden, 2013).

Faculty must model the techniques that students are required to use to set clear course communication and collaboration expectations. Setting high performance standards allows students to determine personal learning strategies which result in demonstration of proficiency in course demands (Young, 2006). High academic standards in the class are reflected in student perceptions, not just of the quality of the class, but the overall quality of education delivered at the institution (Tanis, 2020).

Learning techniques used must attempt to match student learning preferences. Standardized weekly course activities do not take into account differences in student learning (Tanis, 2020). Including a variety of instructional techniques such as case studies, simulations, and stories can engage students to apply course material (Fink, 2013). Allowing students to participate in interactive discussion and applications through reflective exercises creates intentional personal linkages to course content (Hove & Corcoran, 2008). Reaching multiple learning styles necessitates that techniques are authentic, coherent with course objectives, and purposeful (Gedik, Kiraz, & Ozden, 2013). Real-life applications may include current news and outside speakers.

The design of effective remote learning techniques involves realistic operational elements of course design and delivery. Providing clear directions for student navigation, publishing deadlines for course requirements, and articulating the responsibilities of students and the faculty will enable students to navigate the course and adjust their personal approach to learning the content (Fish & Wickersham, 2009).

Models of effective remote delivery focus on creating an environment of trust in which communication, collaboration, and engagement can occur. The seven principles of course design are faculty-student communication and collaboration, student-student communication and collaboration; active learning techniques; prompt feedback; appropriate time for tasks; high-performance expectations, and respect for diverse learning styles (Tanis, 2020, p. 2). Effective techniques build student engagement in their own learning.

### **Student Motivation**

The remote environment has had a significant effect on student motivation with 79% of undergraduate students at 2 or 4-year institutions reported feeling challenged to stay motivated in the online environment (Means & Neisler, 2020). Students need to connect activities and concepts from class to application through active learning that encourages effort and productive contribution to achievement of course goals (Randi & Corno, 2022). This form of learning requires students to be engaged in their own learning. Passively receiving content from the instructor, text, or other media does not foster individual effort or productive academic roles. Students who are motivated to achieve course goals and who have the skills are likely to succeed in the remote environment (Stark, 2019). The focus on achieving course objectives is central to the remote environment. Is the objective just to complete the course, check the boxes and be done? If so, then limited active learning is required. Students need only do the requisite work and then can move on without mastering the concepts.

### **Cheating**

Directly related to poor motivation is the opportunity and pursuit of a faster way to complete course objectives through academic dishonesty or cheating. Research shows 73% of undergraduate students report that it is easier to cheat in an online course versus a face-to-face course with 50% of students surveyed admitting to cheating in an online course, but not in a face-to-face course (King, Guyette, & Piortrowski, 2009). Students taking online quizzes and exams are four times more likely to cheat in an online course by getting answers from others (Watson & Sottile, 2010).

## **Student engagement**

The concept of engagement has been investigated in an educational context (Reschly & Christenson, 2012). Student engagement is defined as a malleable, developing, and multiple-dimensioned construct (Assuncao, et al., 2020, p. 1). Students who are engaged in the classroom participate more in activities, tend to develop mechanisms to help them persevere, and are able to self-regulate their learning processes (Klem & Connell, 2004). Increased satisfaction in their performance in the classroom supports self-efficacy and reduces the probability of student drop-out (Reschly & Christenson, 2012).

Student engagement is defined as having behavioral, cognitive, and emotional dimensions (Maroco, Maroco, Campos, & Fredericks, 2016). Behaviorally, students develop positive normative behaviors. The cognitive dimension includes the thoughts, perceptions, and strategies related to the acquisition of knowledge or the development of skills needed for academic efforts. The third dimension of student engagement is emotional; the positive and negative feelings related to the learning process, class activities, peers, and teachers.

## **Institutional Promotion using the NPS**

Student engagement is hypothesized to be related to institutional brand promotion through the mechanism of student word-of-mouth communication. A simple, but important measure of brand health is the Net Promotor Score (NPS) (Baehre, O'Dwyer, O'Malley, & Lee, 2021). Used by two-thirds of the Fortune 1,000 firms, the NPS is viewed as a key measure of customer loyalty (Baehre, O'Dwyer, O'Malley, & Lee, 2021), an overall measure of brand health. This measure has also been used by educational institutions seeking to improve their brand reputation. While the NPS has been embraced by the corporate community, the measure is controversial in academia. Academics are skeptical of the methodology and variable definition. Firms that have embraced this measure, view it as representative of a transaction-based metric of customer loyalty. Early studies attempted to correlate a firm's NPS with revenue growth (Colvin, 2020); however replication study results were mixed. While the metric may have issues in terms of direct predictive ability of revenue growth, NPS remains an important measure for competitive benchmarking (Markey, 2014). Due to the simplicity of the metric, most organizations are using it as a more global measure of brand health.

Developed in 2003 by Reichheld, the NPS is a survey-based metric that uses one simple question: "How likely is it that you would recommend (company X) to a friend or colleague" (Reichheld, 2003, p. 50). Responses are collected on a 1 (highly unlikely) to 10 (absolutely) scale. Respondents are categorized as "Promoters" if they respond with a 9 or 10, as "Passives" if they respond with a 7 or 8' and "Detractors" if they respond with scores below 7. A simple calculation is made that takes the difference between the number of "Promoters" and the number of "Detractors" divided by the net sample size (Baehre, O'Dwyer, O'Malley, & Lee, 2021). Reichhold considered the NPS to be an indication of "intense loyalty" to a brand. Such loyalty involves a consumer putting their reputation on public view by sharing their recommendation of the brand. This approach to understanding consumer word-of-mouth communication utilizes research that shows dissatisfied customers are more likely to speak about their experiences than satisfied customers (Anderson, 1998). Firms that continue to use this measure of brand health have moved from using the single measure to predict revenue growth, to using the measure as an indication of brand health, with the addition of one question; "Why did you give the answer you gave?". This open-ended question provides productive insights into consumer perceptions of the brand. The NPS has been used in education with a national range of .51 (McKnight, Paugh, Fry, & Song, 2019).

This study proposes a model that examines remote teaching methods, student motivation, and cheating as having direct effects on student engagement. Student engagement is proposed as being linked to institutional promotion using the NPS.

## **Hypotheses**

H1: Effective remote learning techniques will be positively associated with student engagement

H2: Poor student motivation will be negatively associated with student engagement

H3: Cheating will be negatively associated with student engagement

H4: Student engagement will be positively associated with the NPS

## RESEARCH DESIGN

### Data collection

The sample consisted of 273 students from a midwestern liberal arts university. Respondents reported having majors in Business (43%), Liberal Arts (23%), Sciences (17%), and Education (5%) with 10% freshman, 20% sophomores, 20% juniors, 28% seniors, and 22% graduate students. The sample was 60% female, 33% male, the remaining preferring not to respond to gender identity. Survey data was collected using a Qualtrics survey promoted across campus.

The study consisted of exploratory focus groups to identify key dimensions of remote learning methods and student motivation. One aspect of remote learning that was suggested by the focus groups was student cheating. Once the key dimensions were identified, the survey items were developed. The final survey consisted of remote teaching methods, student motivation, cheating, student engagement, and the Net Promoter Scale (NPS).

### Exploratory study

The objective of the exploratory research was to identify the remote teaching methods that resonate with students. Focus groups were held using a wide sample of university students representing the School of Business, Health Sciences, Humanities, and Education. A total of 30 different classes and 156 students participated in the focus groups. Focus groups enabled the researchers to understand the range of remote teaching techniques that have been used on campus from the student perspective. Students identified cheating as a by-product of remote teaching. Information from all focus groups was then categorized into the concepts of teaching methods, student motivation, and cheating.

### Survey research

In addition to the development of survey items measuring remote teaching methods, student motivation, and cheating, student engagement and the Net Promoter Score were measured using existing instruments. Student engagement was measured by the University Student Engagement Inventory (USEI) (Assuncao, et al., 2020). The USEI consists of 15 items and demonstrated a reliability of .84. The net promoter score was measured by a single item (Reichheld, 2003). All items are shown in the Appendix.

### Data analysis

#### Measurement model

Constructs were examined using factor analysis to verify dimensionality. Exploratory factor analysis was used to examine Bartlett's Test of sphericity which is significant at  $<0.05$ . Kaiser-Meyer Olkin measure of sampling adequacy is  $>.06$  which indicate that the sample size is adequate for analysis (Fabrigar & Wegener, 2012). All proposed variables met the requirements for factor analysis. Table 1 shows the test results. All 15 items from the original USEI instrument were used. Reliability of the USEI is .84.

Remote teaching methods consisted of six items with a reliability of .84. The methods identified included faculty to student communication, student to student communication, active learning techniques, and respect for diverse learning styles. Specific methods include peer discussion, multiple delivery methods, detailed examples, games and polls, and questions.

Based on student focus group results, student motivation in the remote environment is viewed as negative. Students indicated that remote classes enabled them to 'be present' in class with little cognitive or social engagement. The six items representing poor student motivation demonstrated a reliability of .91. Items relating to this negative perception include leaving the computer/class while in class, not being focused, not mastering the material, becoming lazier, and having a 'just getting the class done'.

Cheating in remote classes was identified in the focus groups as an important behavioral change due to the lack of face-to-face engagement. Student's indicated that while they would not consider cheating in a face-to-face class, they were inclined to use available resources to aid their grade performance. These resources included asking classmates directly for answers to tests, looking up answers in the text or online, and finding existing materials online. Students felt that there was an assumption on the part of the faculty that cheating occurred. Having limited accountability during online exams, students found it easy to cheat and so were less motivated to learn the material. The four items identified by students demonstrate a reliability of .82.

Table 2 shows the mean scores, standard deviation, reliability and bivariate correlations for all variables. Student motivation has a significant negative correlation of  $-.299$  ( $p>.01$ ) with student engagement. Cheating is positively

correlated to student motivation at .722 ( $p > .01$ ) and negatively correlated with student engagement (-.219,  $p > .01$ ). The measure of student motivation demonstrates the negative impact of the remote environment on student effort to master material. Teaching methods demonstrate a positive correlation with student engagement and are negatively related to student motivation. The relationship between student motivation and the NPS is negative (-.160,  $p > .01$ ) and significant. Cheating is not significantly related to the NPS. Student engagement is positively correlated with NPS.

**Table 1 Exploratory Factor Analysis**

Construct	Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	Bartlett's Test of Sphericity
Student engagement	.83	1339.95 <.001
Teaching methods	.78	490.63 <.001
Motivation	.91	1058.63 <.001
Cheating	.78	413.62 <.001

**Table 2 Mean, Standard Deviation, Reliability and Correlation of Factors**

	Mean	STD	Student Engagement	Motivation	Cheating	Teaching Methods	NPS
Student Engagement	3.96	.47	.84				
Motivation	3.13	1.00	-.299**	.91			
Cheating	2.67	.91	-.219**	.722**	.82		
Teaching Methods	4.04	.54	.415**	-.129*	-.122	.84	
NPS	8.87	2.17	.482**	-.160**	-.070	.201**	Single item
N	273						

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

### Structural model

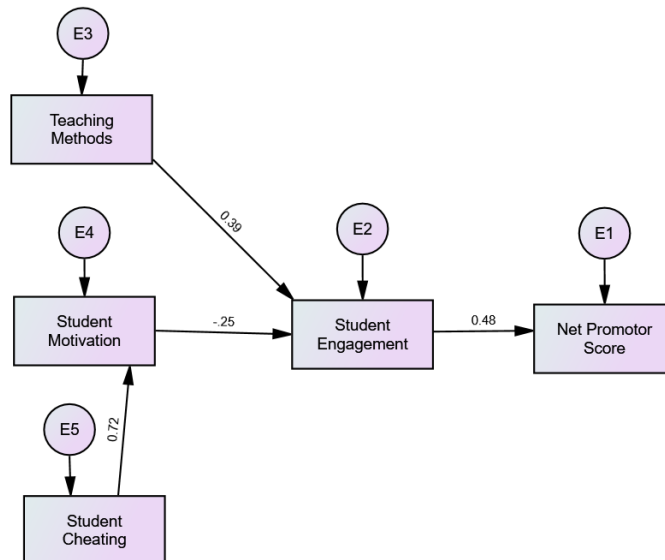
Having evaluated the measurement model, the structural model was examined. Structural equation modeling using AMOS 29 was conducted to evaluate the fit of the hypothesized model. The model proposes that teaching methods, motivation, and cheating are antecedents of student engagement. Student engagement is then proposed as a predictor of the NPS. The fit criteria used were the p-value of chi-square ( $\chi^2$ ) being greater than .05; normed fit index (NFI) being greater than .90, the comparative fit index (CFI) being greater than .95; and the root mean square error of approximation (RMSEA) being less than .06 as stated by Browne and Cudek (1993), Bentler and Bonett (1980) Byrne (2001), and Tabachnick and Fidell (1996). As can be seen in Table 3, the results indicate a poor fit of the proposed structural model;  $\chi^2 = 206.11$ ,  $p = .00$ , NFI = .412, CFI = .404, RMSEA = .350. The path from cheating to student engagement is not significant. Based on this result, the model was adjusted to add a relationship from cheating to motivation, eliminating the direct effect of cheating on student engagement. Model 2 proposed that cheating is an antecedent to motivation. Motivation and teaching methods are then antecedents to student engagement. Model 2 demonstrates improved fit;  $\chi^2 = 6.84$ ,  $p = .34$ , NFI = .980, CFI = .997, RMSEA = .023.

Figure 1 shows the model with standardized regression weights for paths. The structural model supports H1 with a path of .39 ( $p = .000$ ) from teaching methods to student engagement. Teaching methods have a significant effect on student engagement. H2 states that student motivation will be negatively associated with student engagement. This is supported by the model. The path from motivation to student engagement is negative and significant at  $-.25$  ( $p=.000$ ). H3 states that cheating will be negatively associated with student engagement. This is not supported by the model. The path from cheating directly to student engagement was not significant. However, cheating supports the lack of motivation that students experience in the remote environment. Cheating has a path of  $.72$  ( $p=.000$ ) to motivation. H4 states that student engagement will be positively associated with the NPS. This relationship is supported by Model 2. The path from student engagement to the NPS is significant at  $.48$  ( $p=.000$ ).

**Table 3: Structural Model comparison**

	$\chi^2$	df	p	NFI	CFI	RMSEA
Model 1 – Cheating as antecedent of Student Engagement	206.11	6	.00	.412	.404	.350
Model 2 – Teaching Methods, Motivation as antecedents of Student engagement. Cheating as antecedent to Motivation.	6.84	6	.34	.980	.997	.023

**Figure 1: Structural Model**



## DISCUSSION

The present study focused on the relationship between remote teaching methods, student motivation and student engagement that leads to institutional promotion (NPS). Drawing from 273 participants two models were evaluated using structural equation modeling testing for the effect of teaching methods and motivation on student engagement leading to positive institutional promotion. The Net Promoter Score (NPS) is widely used incorporate settings as a simple measure of brand loyalty (Baehre, O'Dwyer, O'Malley, & Lee, 2021). This concept of brand loyalty in higher education provides insight into the willingness of students to promote the institution to others. A central question is

‘what leads a student to give positive word-of-mouth testimony to others?’. The intensity of student engagement at the institution is an important determinant of participation in activities, perseverance in degree completion, and self-regulation of learning processes (Klem & Connell, 2004). As student engagement is defined as having behavioral, cognitive, and emotional dimensions (Maroco, Maroco, Campos, & Fredericks, 2016), the emotional dimension or the positive and negative feelings related to the learning process, class activities, peers, and teachers is the link between student engagement and institutional promotion.

Student engagement facilitates positive normative behaviors, the development of skills needed for academic efforts, and the positive and negative feelings related to the learning process, class activities, peers, and teachers (Maroco, Maroco, Campos, & Fredericks, 2016). Specific teaching methods should promote student engagement in the classroom, in their own learning, and in the institution. The remote environment has changed the teaching methods used from traditional face-to-face methods to technology enabled methods. This study sheds light on how remote teaching methods have affected student engagement. The human factor remains a significant element in effective remote teaching methods. Faculty to student communication is supported by faculty checking for understanding. Student to student communication and collaboration is supported by peer discussions. The active learning techniques of using detailed examples, games and polls are identified as important items. Faculty that use various methods are also viewed as effectively addressing diverse learning styles (Tanis, 2020).

Student motivation is viewed negatively in the remote environment. Students reported leaving the computer/class while in an online class because they were not focused. Difficulty in paying attention and not being mentally in the class were reported. Not mastering the material and viewing the class as something to ‘just get done’ were reported. Subsequently, this poor student motivation has a negative impact on student engagement. Related to poor student motivation is cheating. The prevalence of cheating in the remote environment (Watson & Sottile, 2010) is supported by this study. There was an assumption of cheating in the remote environment with limited student accountability. Students reported that it was easy to cheat online. Because of the ease of cheating, students were less motivated to learn the material. Cheating did not affect student engagement directly, but rather affected poor student motivation.

This study contributes to understanding the remote teaching methods that are most effective at engaging students in their own learning. The human connection with faculty in the remote environment is a critical dimension to student engagement. Drawing the link between specific remote teaching methods, student engagement and subsequent positive Net Promoter Score for institutions captures the connection between the student experience in class leading to positive word-of-mouth support.

### Limitations

Three main limitations of the present study need to be recognized. The first limitation is the cross-sectional design of the current study. Based on the cross-sectional design, the study is unable to project the long-term or causal effect of remote teaching methods, student motivation, and student engagement on the Net Promoter Score. The purpose of the study was to expand understanding of how specific remote teaching methods effects student engagement and how student engagement affects institutional promotion. Despite the lack of causal inference, the results provide support for the model of specific remote teaching methods that facilitate student engagement leading to positive institutional promotion. Second, the current study is based on a sample of liberal arts students at a private university. Adding to the sample size with public university students would be productive. Third, data in the current study were obtained using self-reports, which means that common method variance may have influenced the findings. Common method variance may overestimate the associations among variables (Spector, 2006).

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## Appendix

<b>Student Engagement</b>	
1.	I pay attention in class
2.	I follow the school's rules.
3.	I usually do my work on time.
4.	When I have doubts, I ask questions and participate in debates in class.
5.	I usually participate actively in group assignments.
6.	I don't feel very accomplished at this university. (R)
7.	I feel excited about schoolwork.
8.	I like being at school.
9.	I am interested in the schoolwork.
10.	My class is an interesting place to be.
11.	When I read materials, I question myself to make sure I understand the subject I'm reading about.
12.	I talk to people outside the university about matters that I learned in class.
13.	If I do not understand the meaning of a word, I try to solve the problem. For example, by using outside resources or by asking someone else.
14.	I try to integrate subjects from different disciplines into my general knowledge.
15.	I try to integrate the acquired knowledge into solving new problems.
<b>Teaching Methods</b>	
1.	It was helpful when my peers participated in class discussion.
2.	It was helpful when the faculty used various methods during class (discussion, PowerPoint, video, questions, etc.)
3.	It was helpful when professors used detailed examples.
4.	It was helpful when professors used games to aid in learning experiences.
5.	It was helpful when professors used polls to engage with the class or check understanding.
6.	It was helpful when professors checked understanding by asking questions throughout the class.
<b>Student Motivation</b>	
1.	I left the computer/class while in an online class because I wasn't focused.
2.	It was difficult to pay attention during online classes.
3.	I was able to pass the class without mastering the material.
4.	I attended class, but I was not mentally there.
5.	I got lazier with online classes.
6.	My mindset during an online class was to 'just get it done.'
<b>Cheating</b>	
1.	The instructor assumed that students were cheating.
2.	There is limited student accountability during online exams.
3.	I found it easy to cheat online.
4.	Because of being able to cheat, I was less motivated to learn the material.
<b>Net Promoter Scale</b>	
	Would you recommend your University to a friend or family member?

# Teaching Data Literacy and Sports Economic Fundamentals Using Fantasy Sports

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## ABSTRACT

Teaching data literacy and sports economic fundamentals can be seen by students as unengaging when taught in the traditional lecture format. An activity using student participation in a fantasy league draft was used to actively engage students. This activity focused on learning the economic concepts of the Noll-Scully measure, Gini coefficient, Lorenz curve and the Herfindahl-Hirschman Index (HHI). Marginal product was used to evaluate player performance, and competitive balance were used to evaluate league performance. It also taught data literacy skills such as locating and entering data and using Excel functions to organize and clean data. Students ran regression models to proxy the concept of marginal product in evaluating relative performance and collected data to compare players' predicted point contribution. The activity can be refined for similar courses in data literacy and sports economics.

**Keywords:** data literacy, economics; fantasy sports; Microsoft Excel; competitive balance; marginal product

## INTRODUCTION

The activity discussed in this paper successfully used participation in a fantasy baseball league to teach the economic concepts of marginal product and competitive balance. Leveraging students' interest in sports to teach economic principles can engage students and lead to a worthwhile and enjoyable learning experience (Bruggink 1993; Collins and Hoffer 2016; Leeds 2022; Mahar and Paul 2010). The film *Moneyball* popularized the idea of how a Major League Baseball (MLB) team, the Oakland Athletics, can gain competitive advantage over other teams by adopting, before other MLB teams, the econometric analysis of the effect a baseball player's performance has on team wins (sabermetrics). This method was used to determine which players to draft (Hakes and Sauer 2006). The activity in this paper builds off the idea of econometric analysis and applies it to a classroom setting.

The activity is focused on the important sports economics idea of uncertainty-of-outcome hypothesis (UOH). The UOH is important, as it has been shown that fans value competitive contests. If the league is balanced (high uncertainty of outcome), then fans will report a more favorable experience (Eckard, 2017). As uncertainty-of-outcomes is important for fan interest (Knowles, Sherony and Hauptert 1992; Rottenberg 1956; Schmidt and Berri 2001), league commissioners seek to maintain competitive balance to boost fan interest, attendance, and revenue (Levin, Volcker, and Will 2000). Various measures of competitive balance in sports leagues can be calculated based on the number of wins per team; these measures have several corollaries with similar constructions in other economic fields. The measures used in this activity are the Noll-Scully measure, Gini Coefficient, and Lorenz curve. These are based on the literature on income inequality. The Herfindahl-Hirschman Index (HHI) is also used, and it is a concentration index based on the antitrust literature. The activity that is discussed in this paper uses these sports economic terms to evaluate teams and leagues after a simulated season. The simulated season was generated using teams that the students had drafted using student-generated Microsoft Excel spreadsheets. This allowed students to see the impact of their decisions on league competitiveness through data that they had directly generated.

## Previous Work on Economic Fundamentals

A review of the literature found previous work (Porter et al., 2004) related to the activity described in this paper. A comprehensive review on using simulation models to teach economic concepts covers a wide range of useful topics and provides good foundational knowledge. Two articles go in more detail into describing baseball simulations to leverage students' interest in sports to teach economic concepts and data literacy. The first article (Baird, 2005) describes an activity where students role-played as team managers with the job of filling the same three positions by bidding on free agents. Managers were given hypothetical data on players' marginal-product, revenue information

(extra revenue and extra wins for each), and players were auctioned off by positions where the highest bid won. With baseline information on pre-acquisition won/lost records, payroll, and revenue, students calculated the after-acquisition won/lost record, payroll, and profit. The activity reinforced understanding of the connection between a player's marginal product, marginal revenue, and team profits. The activity aimed to teach a course on the principles of economics that could be taught in a single class. The second article (Wooten and White, 2018) described an activity where students collected data from public sources on the 30 MLB teams. They obtained data on team won/lost record, individual player salaries, team offensive statistics, individual offensive statistics, attendance at team games, and average ticket prices. Using information on team offensive statistics and team revenue, a marginal revenue product equation was estimated. Coefficients of the output were then used to calculate each player's estimated marginal revenue product. Accordingly, the students determined which players were overvalued or undervalued. They drafted a nine-player team, using the budget provided to them, and participated in a simulation for an entire season. The simulation generated won/lost records. The activity reinforced understanding of the concept of player valuation shown in the movie *Moneyball*. Through role-play, students applied these concepts to simulated scenarios that the manager of an MLB team might experience. The approach presented in this paper builds on and extends the previous work. The activities above (Baird, 2005; Wooten and White, 2018) focused on using marginal revenue product for player valuation, drafting players subject to a budget constraint, and using simulation software to generate a season's won/lost record. The activity in this paper used marginal product for player valuation in developing draft picks while using the ESPN platform to conduct the draft. Upon completion of the draft and simulation of a season, the activity provided students with the won/lost outcomes to calculate the competitive balance.

### **Importance of Data Literacy**

A goal of undergraduate programs in economics is data literacy (Batt, Grealis, Harmon, Tomolonis 2020; Hoyt and McGoldrick 2017; Halliday 2019). Thus, working with quantitative measures and tools such as Excel helps achieve this goal (Calvert, 2020). In almost every industry, Excel is used widely for data processing. Even if Excel is not used, the methods and principles behind it carry over and are applicable to other data processing programs. Often, Excel is taught through mechanistic activities that walk students through basic functions and options. While useful, these activities are not as engaging as students might like. In teaching undergraduate courses, the most effective lessons are the ones that connect the student's life with the course material (Calvert, 2021; González-Marcos et. al., 2016; Sitaraman, M. et. al., 2009; Warren 1997).

Therefore, to engage the students, this activity ties into a popular sport, as student success can be correlated with how engaged students are with the course material (Carini, Kuh, and Klein 2006). While there are many formal techniques to engage students (Geist and Myers 2007; Ibrahim 2016; Sitaraman et al. 2009), engaging them with an active learning opportunity will help them by increasing their perceived connection to the material. Once they have been drawn into the activity, the mechanics of Excel can be discussed in the context of the activity. Various Excel functions such as VLOOKUP, FILTER, REGRESSION from the Analysis ToolPak, STANDARD DEVIATION, SUMMARY STATISTICS, IF THEN, HIDE, and CHART are common functions that students may encounter in future courses and will likely need to use in their professional settings. Through this activity, students created knowledge rather than just received knowledge (Ojiako, Ashleigh, Chipulu, and Maguire 2011). This created a stronger connection with the technical material and a better learning environment.

### **Objectives**

The objective of this activity was to illustrate the concept of competitive balance through an analysis of player productivity. Students' interest was found to be heightened by leveraging their sense of identification with the data as they self-selected players on their fantasy team. An added benefit of the activity was that it showed how Excel could be used in a relatively complex selection process. While a basic understanding of Excel was necessary, prior knowledge of baseball was not found to be essential, and students were assigned to watch the film *Moneyball* in preparation for the activity. The activity is appropriate for teaching in courses such as an upper-level course in sports economics, an intermediate microeconomics course focusing on the topic of labor markets, a labor economics course, an econometrics course, and others. For use in a graduate-level course, additional evaluations could be added, and the work could be performed individually. The activity was successful in teaching the concepts and in engaging the students.

## METHODS

### Learning Goals, Objectives, and Outcomes

The activity developed for this work first started with defining the learning goals, objectives, and outcomes. Table 1 summarizes the goals, objectives, and outcomes of this activity. The first goal of engagement was the primary driver for developing the activity. Teaching data literacy and economic fundamentals using traditional lecture methods may not connect with students and not demonstrate the usability of the concepts outside of class examples. The activity that was developed had students working with the concepts using fantasy sports – specifically baseball. Fantasy sports are commonly played by college students for enjoyment. This combination of academic and non-academic components was developed to create a better connection of the concepts to the students. The second goal of data literacy used Excel as the teaching tool. The data entry, functions, and analysis used for the activity were commonly used ones that will allow the skills to transfer to other uses of Excel. The final goal of sports economic fundamentals was accomplished by incorporating key concepts into the fantasy sports league draft and post-season competitiveness analysis. The combined learning goals, objectives, and outcomes were met as seen by students’ written and oral feedback.

**Table 3: Learning Goals, Objectives, and Outcomes for this Activity**

Goal	Objective	Outcome
<b>Engagement:</b> Create an in-class activity to engage students in learning data literacy and economic fundamentals	Students will use a fantasy sport scenario to learn data literacy and economic fundamentals	Students will complete an after-activity survey and assessment to indicate a positive reaction to the activity
<b>Data Literacy:</b> Learn advanced Excel functions in a practical setting	Students will use advanced Excel functions to select a fantasy sports team	Understand how advanced Excel functions impacts player valuation
<b>Sports Economic Fundamentals:</b> Learn calculation of competitive balance and marginal product	They will go from learning a theoretical concept to measuring it with data	Calculate four measures of competitive balance, and estimate players’ marginal product

### Activity Overview

The first part of the activity required students to develop a list of draft picks. To do this, students were provided instructions on how to evaluate players by using the concept of player marginal product and regression analysis. Students then used a data file, provided by the instructor, containing individual baseball player offensive batting statistics. For this activity, following the previous literature (Krautmann et al. 2009; Scully 1974; Sommers and Quinton 1982; Wooten and White 2018), students estimated player productivity using coefficients from their regression model. The total team fantasy points was the dependent variable, and various measures of offensive statistics were used as independent variables. To participate in the activity, the only knowledge of baseball students needed were fundamental rules for walks, strikeouts, hits, runs, outs per inning, scoring runs, and making outs. Students were provided a discussion in class to teach these fundamentals. Additionally, students were encouraged to watch the film *Moneyball*, which explains the transition of MLB player valuation from simply based on hits (batting average) to one based on walks and hits (on-base percentage). After completion of their preferred draft selections, students used their lists to select players during a live ESPN Fantasy draft. This draft only included students from the class. Once the draft was complete, a simulation program, Out of the Park Baseball, was used to simulate a full MLB season. An Excel file was then used to map team player selections with player simulation results. League results were generated with total team fantasy points acting as a proxy for the won/lost results for each team. After the results were generated, students then calculated the four measures of competitive balance: Noll-Scully index, Gini coefficient, Lorenz curve, and HHI.

NOTE: The activity in this study used the free ESPN Fantasy Baseball league platform to form a league of teams and draft players. For readers that are not familiar with setting up or running a fantasy draft, further information is available in the supplemental information available online with an access link below. The link is found before the references in this paper. This information includes drafting instruction, an activity checklist, a video overview, and other specifics to act as a guide in setting up the leagues.

### Using a Regression to Estimate Player Marginal Productivity in Excel

The regression analysis was developed and performed by the students to guide their selection of draft picks. An initial homework assignment was given where students used a linear regression model to estimate the productivity of the

players they were evaluating as potential draft picks. In the homework assignment, player valuation was estimated by a two-step process. Students used equation (1) to estimate player production using the Excel REGRESSION function, where the data were from the previous season's simulation. To keep the required amount of baseball knowledge minimal, offensive measures were limited to batting averages and home runs.

$$\text{Player Total Points}_i = b_0 + b_1 \text{Player Batting Average}_i + b_2 \text{Player Home Runs}_i + \varepsilon_i, (1)$$

where  $i$  = each player.

Second, to demonstrate the application of equation (1) in selecting draft picks, students were asked to download recent season player statistics and then insert the marginal product coefficients from equation (1) into equation (2) to calculate predicted values for two players as part of the homework assignment.

$$\text{Estimated Player Total Points}_i = \hat{b}_0 + \hat{b}_1 \text{Player Batting Average}_i + \hat{b}_2 \text{Player Home Runs}_i, (2)$$

where  $i$  = each player, and  $\hat{b}_0$ ,  $\hat{b}_1$ , and  $\hat{b}_2$  are the estimated coefficients from equation (1).

For a sample player productivity calculation, students were asked to compare the predicted values of two MLB players: University of Connecticut (UConn) alumnus George Springer, recipient of the 2017 World Series Most Valuable Player (MVP), and Mike Trout, a three-time American League MVP. Students were then provided the following data: George Springer had a 0.292 batting average with 39 home runs. Mike Trout had a 0.291 batting average with 45 home runs. Using equation (2), students calculated a predicted point total of 498 for George Springer and 565 for Mike Trout. Students then input their answers into a self-graded Excel table to provide instant feedback. NOTE: An average baseball player had a 0.243 batting average with 17 home runs – assumes 600 plate appearances. The comparison of player productivity demonstrated to students the impact of different statistical contributions on total player valuation. Students were then asked to download an instructor-provided dataset of player statistics, including batting averages and homeruns, and add a column for the marginal product using equation (2). After completion, students had learned how player valuation measures are developed using data. The resulting spreadsheet comparing player valuation measures was used during the draft for students to select players. The Excel FILTER function was used to filter the table for specific parameters and decrease the time needed to draft players.

Class time was reserved for discussion of the formulas and merits of the different valuation measures. Players and their corresponding data were shown in tables to facilitate the discussions on player value. Table 2 displays the data sorted by the position of right field and then on-base percentage. For instance, it was asked, “who is better – George Springer or Aaron Judge?” Springer has a higher on-base percentage but a lower slugging percentage and marginal product than Aaron. Or, for example, based on the on-base percentage measure, Michael Conforto is less valuable than Alex Verdugo when using more traditional stats such as AVG, but he might be considered undervalued based on his higher marginal product value. A discussion of why certain players ranked better on one measure compared to another enhanced the students' understanding of the valuation measures. This understanding was demonstrated when the students were given the option to re-rank their player list. After discussions with students, it was seen that students had begun to ask themselves if they should use a different order based on their newfound data analysis skills.

**Table 2: Player Valuation Comparisons**

Name	POS	AVG	wOBA	OBP	SLG	MP
Bryce Harper	RF	0.261	0.413	0.399	0.528	434.8
Khalil Lee	RF	0.207	0.337	0.395	0.310	53.7
George Springer	RF	0.269	0.400	0.381	0.509	436.7
Aaron Judge	RF	0.258	0.395	0.369	0.537	545.7
Alex Verdugo	RF	0.300	0.366	0.369	0.439	187.4
Nick Markakis	RF	0.305	0.363	0.363	0.438	110.5
Ronald Acuna Jr.	RF	0.275	0.362	0.359	0.442	281.9
Charlie Blackmon	RF	0.304	0.380	0.358	0.494	255.4
Michael Conforto	RF	0.249	0.359	0.355	0.447	342.7
Tyler Wade	RF	0.229	0.302	0.354	0.265	47.8
Adam Eaton	RF	0.281	0.332	0.353	0.389	182.9

NOTE: POS: position; RF: right field; AVG: average; wOBA: weighted on-base average; OBP: on-base percentage; SLG: slugging percentage; MP: marginal product.

There were other drafting tools that were shared with the students. They could be used along with their self-generated Excel-based tool. These tools included ESPN's player rankings, available in the ESPN Platform. Other tools include online resources such as RotoGraphs, Razzball, YahooSports, and CBSSports. Finally there was an option for an Excel-based OPIE tool that was developed by one of the instructors. These alternate tools could allow for flexibility for instructors who want to modify the activity. Whether the students relied solely on their generated values or included other options, they gained experience with data literacy and economic principles through a systematic analysis of the player data.

Students were found to be more engaged when they knew the players. For instance, a Yankees fan is more likely to select players from the Yankees. Not only is a Yankees fan more familiar with a player from the Yankees, the fan also has more incentive to cheer for the Yankees. A Yankees fan is not as likely to pick a player from a rival team such as the Red Sox, because then the Yankees fan would have to cheer-on a player from a team that the fan would want to lose. This phenomenon is seen when there were teams that had multiple players from the same team, and in teams that selected lower rated players because the player was from a favorite team.

### Competitive Balance Activity Using Excel

An additional learning component of this fantasy baseball activity was for students to evaluate the competitiveness of each league using Excel. In this activity, students used results from the simulated season to compare the competitive balance in each league. Upon completion of the draft, the Out of the Park Baseball program was used to simulate the season's point totals for each player. From these data, the season's point totals were generated for each team, and standings for each league were calculated using the VLOOKUP and SUM functions to match players drafted on each team to their simulated results. Table 3 shows results for an individual team, and Table 4 shows the results for an individual league. Note that Dummy teams were used if there were not enough teams for a full league. These teams were auto-drafted by ESPN's auto draft feature.

**Table 3: Sample League Result Sheet for One Team**

Team: Dunhill		
POS	Player	Points
C	Yasmani Grandal	299
1B	Cody Bellinger	363
2B	Ketel Marte	438
3B	Eugenio Suarez	192
SS	Fernando Tatis Jr.	392
OF	Nick Castellanos	159
OF	Luis Robert	295
OF	Andrew Benintendi	323
P	Walker Buehler	610
P	Blake Snell	645
P	James Paxton	358
P	Mike Soroka	382
	Total	4,456

Note: POS: position; C: catcher; 1B: first base; 2B: second base; 3B: third base; SS: shortstop; OF: outfield; P: pitcher.

**Table 4. Sample League Result Sheet for One League.**

Rank	Team	Points
1	Dunhill	4,456
2	Efrat	4,365
3	Cruz	4,246
4	Patterson	4,156
5	Deng	4,152
6	Glizzy Gladiators	4,135
7	Storrs CT Jiangsu FCB	3,797
8	Bailey	3,741
9	Dummy	3,669
10	Dummy2	3,374

Students used an instructor-provided template to calculate four measures of competitive balance: (i) Noll-Scully (SD), (ii) HHI, (iii) Gini coefficient, and (iv) Lorenz curve. The template could be adjusted to increase the degree of student manipulation of the data. For example, the student could be asked to write the VLOOKUP formulas to read the data from the “Results” file to the “Competitive Balance” file, or they could be asked to write the formulas for various competitive balance measures. The different approaches to data tabulation is an important feature of this activity. This allows the activity to be adjusted to the level of skill of the students with the more advanced students required to do more of the data tabulation.



**Figure 2. Completed Competitive Balance Table.**

ECON 2447 League A				ECON 2447 League A								
Team	Points	Share %	Share Squared	Team	Points	% of Points	% of Teams	Cumulative % of Teams	Cumulative % of Points (A)	Perfect Equality	Area under the Lorenz Curve	
1 Dummy2	3374.01	8%	8.42	70.83	Dummy2	3374.01	0.08	0.10	0.10	0.08	0.10	0.0042
2 Dummy	3668.98	9%	9.15	83.75	Dummy	3668.98	0.09	0.10	0.20	0.18	0.20	0.0130
3 Bailey	3741	9%	9.33	87.07	Bailey	3741	0.09	0.10	0.30	0.27	0.30	0.0222
4 Storrs CT Jiangsu I	3796.99	9%	9.47	89.70	Storrs CT Jiangsu F	3796.99	0.09	0.10	0.40	0.36	0.40	0.0316
5 Glizzy Gladiators	4135.01	10%	10.31	106.38	Glizzy Gladiators	4135.01	0.10	0.10	0.50	0.47	0.50	0.0415
6 Deng	4152.01	10%	10.36	107.26	Deng	4152.01	0.10	0.10	0.60	0.57	0.60	0.0519
7 Patterson	4156	10%	10.37	107.46	Patterson	4156	0.10	0.10	0.70	0.67	0.70	0.0622
8 Cruz	4245.97	11%	10.59	112.17	Cruz	4245.97	0.11	0.10	0.80	0.78	0.80	0.0727
9 Efrat	4364.99	11%	10.89	118.54	Efrat	4364.99	0.11	0.10	0.90	0.89	0.90	0.0834
10 Dunhill	4456.01	11%	11.11	123.54	Dunhill	4456.01	0.11	0.10	1.00	1.00	1.00	0.0944

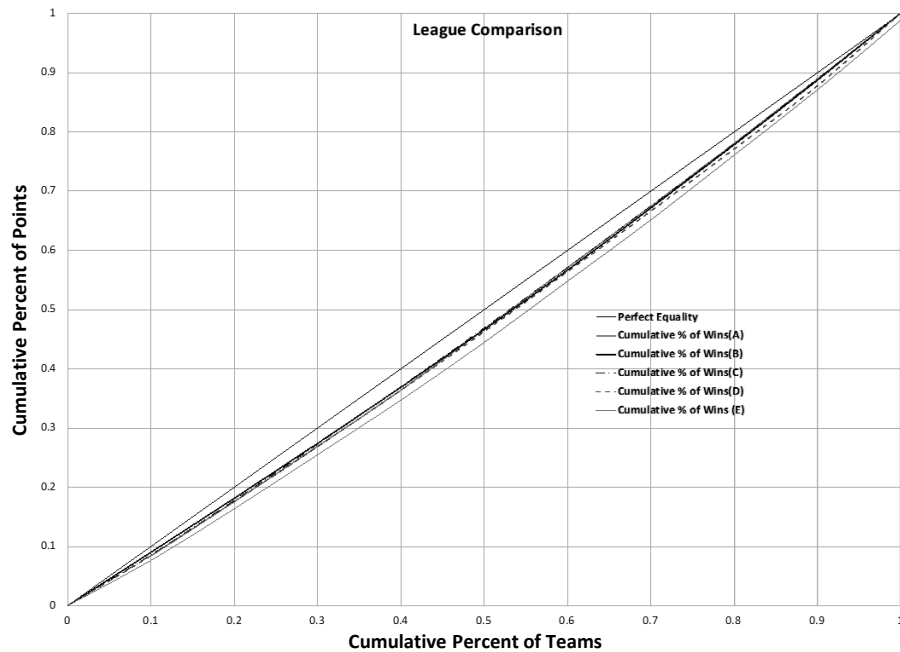
RESULTS			
Standard Deviation of Points	345.8	HHI	1007
Idealized Standard Deviation		Area A	0.023
COMPETITIVE BALANCE RATIO		GINI	0.045

Excel Functions:	
• Sort	
• Mathematical Operators: +, /, *	
• Standard Deviation	
• Chart	

An example of a completed league table is shown in Figure 2. Part A of Figure 2 illustrates the cells where the student entered and sorted fantasy teams, from lowest to highest, based on the total points for each team in the league. The Noll-Scully measure was calculated using the Excel function for SD and is reported in Part D. The HHI, calculated in Part B and reported in Part D, was designed to gauge power concentration within a market while exposing students to a popular antitrust measure used in several modern applications (Salvatore 2009). In this application, students could quantify a sports team’s potential dominance, calculated through a summation of the squared market shares of each firm within a market. Index values closer to 1 indicate a strong concentration of market power, whereas numeric results closer to 0 indicate a very competitive market. A common practice in sports literature (Depken 1999; Humphreys 2002, Owen, Ryan, and Weatherston 2007) is for the HHI to be calculated by squaring a ratio of the individual team wins to total wins within the competition. The HHI formula was adapted to square the ratio of the total team points for an individual to the total fantasy points within the league. The Gini coefficient, calculated in Part C and reported in part D, is often used to evaluate inequalities between factors. It was used in this analysis as a proxy of equal competition. Substituting the income percentile with the percentile of league points allowed for a sports league variant of the traditional Gini coefficient. Through this template, already set up in the Excel question sheet, students gauged the point inequalities between each league and could then begin to consider the economic mechanisms driving these differences.

**Figure 3: Lorenz Curve Competitive Balance: League Comparison Graph**



After carefully reviewing and interpreting the statistics of competitive measures, students were finally asked to compare and rank the leagues based on their analysis of competitive balance. When asked to rank the leagues, students reinforced previous course learning goals by examining the reasons for competitive differences. Students charted an aggregate Lorenz curve, for multiple leagues, to help them visually rank the competitiveness of each league. The Lorenz curve in Figure 3 provided students with a visual comparison of competitive balances among the leagues. The Lorenz curve is a graphical representation of the Gini coefficient. The curve for perfect equality is a straight line at a 45-degree angle (corresponding to a Gini coefficient equal to “0”), and the curved lines below represent increasing degrees of inequality (Gini coefficients greater than “0” and equal to or less than “1”). The more sloped or curved the line is the more inequality in a league. The data from five leagues is shown. League A, B, C, and D were similarly competitive but still below the ideal competitive line. League E was below the other leagues and demonstrated a less competitive league. Part E in Figure 2 summarizes the Excel tools used in this assignment. By interpreting Figure 3, students observed that leagues closer to the perfect line of equality were the most competitive, whereas leagues farthest away were the least competitive. By understanding the leagues’ competitiveness, students could better examine factors that may or may not drive these competitions. Thus, the use of competitive balance analysis allowed students to apply economic theories to real, self-generated data (drafted teams) and understand factors that may drive the underlying imbalance in the overall class data.

### STUDENT FEEDBACK

When developing an activity, it is important to understand how the participants experience the activity. Thus, to understand the student experience, three questions were asked to each student after the activity. The questions and responses are provided in the supplemental information. The first question asked was, “*What impact did the baseball activity have on your learning/understanding of sports economic principles?*” This question helped determine if the activity was able to connect to the course theory and content, which is an important goal. The responses generally contained themes similar to the comment, “The baseball activity showed how there can always be economic topics applied to the situation; it gave me an understanding of how to collect information for interpretation on the players/teams.” The second question asked was, “*What part of the baseball activity did you find most meaningful; how could this be applied to other parts of your courses or life?*” This question required students to think about how the content could go beyond the classroom. While many of the answers indicated no impact, the ones that did commonly mentioned how it helped their understanding of Excel or theory (statistics or economics). The third question asked was, “*For the baseball activity, what improvements would you suggest for the activity? This could be in the*



so that they can be used for different learning levels. This helps to minimize the preparation time and also allows for multiple uses. Using an activity multiple times allows for further refinement to the instructor's course and subsequently better learning outcomes for the students. The activity in this paper has demonstrated its ability to meet stated course learning outcomes and outlines some potential changes that instructors could use to refine it or adapt it for other courses.

## ACKNOWLEDGMENTS

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## CONFLICT OF INTEREST

None.

## ETHICAL CONSIDERATIONS

This study was conducted in compliance with IRB guidelines.

## SUPPLEMENTAL INFORMATION

All supplemental information can be accessed using the following link.

<https://docs.google.com/document/d/1yAUNHf-B6fZGJg5A5eeYBdT7ZVE2oRn0/edit?usp=sharing&oid=108451590709067737756&rtfpof=true&sd=true>

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# A Responsive Methodology for Developing Student Research Skills

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## ABSTRACT

Successful data analytics begins with the quality of the data used for analysis. This paper addresses developing superior data analytic search skills in a class that requires students to demonstrate their preparation to apply their acquired proficiencies to their future endeavors. Students prepare a comprehensive 8-10-page analytic paper.

**Keywords:** Online Dataset Research, Skill Development, Google Dataset Search, Internet Searching, Preparedness, Employability, and Curriculum Planning

## INTRODUCTION

Traditionally the acquisition of substantive research skills was restricted to a select few referred to as the cream of the crop (Henderson & Kose, 2018). However, the rapid growth of the World Wide Web in and of itself requires research skills to use the wealth of information available on the Internet (Huy, & Thuy, 2021; Khan, Welsler, Cisneros, Manatong, & Idris, 2020). According to (Rodenbusch, Hernandez, Simmons, & Dolan, 2016) involvement in course-based research early on in undergraduate careers increases the likelihood that a student will graduate within six years. More importantly, research exposure impacts student efforts to meet employer requirements, who fully expect students to arrive on the job with research skills (Tinh, Thuy, & Ngoc, 2021).

So, a diversified group of students must be supported, ranging from those that have never used the required software to those that possess advanced skills. With this type of diversity in mind, three data analytics courses were developed to support students in their quest to improve their research skills. Specifically, the second in a series of three courses was developed to support students to meet their expectations of what they knew they could do. Consideration of employer expectations was also factored into the type of support students would receive.

## THEORETICAL FRAMEWORK

A recent study showed that the use of online tools during the learning process improved students' engagement and performance levels (Elbasyouny, 2021). The goals to support the students in the data analytics courses included the goals of increasing engagement, minimizing boredom, and enhancing performance. Students typically skip homework considered not important to their learning and grade. However, when the course is geared to support an assignment with detailed instructions, then students consider the assignment important and complete the coursework.

Marsh & Rajaram (2019) spoke to the digital mind expansion due to the changing nature of information available on the Internet. Likewise, creativity is an aspect of learning through research that can be nurtured in students. That sort of ingenuity is the goal of students who learn by association (Brahler & Walker, 2008). For students to learn for the long-term, rote memorization is less effective than learning by association (Pressley, Levin, & Delaney, 1982). Learning by association generally generates creativity and therefore time efficiency (Levin, 1980). Time to do better and be creative is what is strongly desired by students for strong business careers.

## CONTRIBUTION AND BRAINSTORMING MODEL, THE PROCESS

When hired into my current position by the Dean of Business Administration at USCA to teach the data analytics classes, the dean wrote me a note in answer to the question posed. It turned out that the students for the second class in the series of three were expected to write a data analytics paper at the end of the course. The reality was that many students opted not to write the paper. Finding a dataset and writing an analytics paper was the whole point of the course. This idea was not getting through to the students. This scenario was changed because of the new support level afforded to the students. New assistance included in-class librarian-led sessions, handouts, a detailed scheduling grid, chunking to build-in assignments step-by-step up to the final project, and one-on-one librarian appointments. The grading component increased so that students could not skip the final project assignment and expect a good grade.

According to the dean, the school had paid good money to update the courses right before I arrived. Importantly, the currently crafted courses required students to compose an analytic paper that showcased their analytical writing skills, Excel expertise, and statistical knowledge. The accumulation of many students who chose not to exhibit their acquired skill set was bothersome to the dean. This was upsetting, especially when students moved to the third class in the data analytic series, and then ultimately into the workforce without the skill sets the school claimed they possessed.

So, the primary objective as laid out by the dean was to find ways to encourage and support students to learn how to find datasets and write quality analytic papers. This goal was important because the dean kept repeating it and we convened in a recorded conversation using Microsoft Teams to discuss this at the inception of my employment, which started in the fall of 2020. After one semester of observation with the dean as a co-instructor for the courses, ideas were generated.

Throughout the first term of teaching the course, students commented that they did not remember their Excel or Statistics skills. Therefore, the students spent time in class through Excel assignments and Statistics exams, refreshing their memories. These course portions helped develop better researchers, analysts, and effective writers. An overview of the input process from the instructor, library personnel, dean, students, and employers is depicted in Appendix A. To refresh their memories, students spent time in class reviewing and applying statistical concepts via four exams and practicing using Excel assignments. The Excel projects required six analytic papers (each requiring a two-page mini-analysis) to develop higher-order writing skills. Three of the Microsoft Excel projects were guided, step-by-step instruments, and three of the Microsoft Excel projects were free-hand or creative vehicles designed to evaluate student skill levels. This way, the students were ready to use Excel and Statistics in the final project combined with analytical writing. These course components helped students develop where needed to feel comfortable completing the final project.

Each of the six Microsoft Excel projects had to be analyzed and written up in Microsoft Word. Two full pages of summary analysis double-spaced were required. Each analytic write-up had to be submitted along with the completed Excel project. These summaries were practice essentials that prepared students to write the 8-10-page paper due at the end of the term.

The course needed several tools, the primary of which included step-by-step instructions about how to find a qualified dataset to become familiar with prior to writing an analytic paper. Researching to find datasets is different than googling something and using the Internet to find general information. So, there was a desire on my part to bring this portion of the course up to speed quickly.

Thus, at this point, the library and personnel and its resources became of utmost importance. I especially tuned in to the library resources when I discovered that there was a specialist who was a government documents librarian. There was quite a natural partnership that developed when I partnered with the library.

As part of the support mechanism for the students, the government documents librarian has been important in helping students to become more competent researchers when it comes to finding qualified substantive datasets. Hands-on sessions with the government documents librarian during the third week of class proved to substantially assist the students in finding qualified datasets for the final project, writing an analytics paper. In addition to this, the students were provided with two handouts developed with the government documents librarian for class use. This was key to the successful support mechanisms placed for the students in this class.

The first section of the handout (Research Strategy) begins with helping the students to start to think about and write out ideas about topics that they desire to pursue. The second section of the Research Strategy handout provides a list of past topics that students have been particularly successful with when finding substantive and most likely qualified datasets to work with for the final project.

The third section of the Research handout lists some of the best sources for finding good datasets. This section provides actual links the students can use from an electronic version of the handout. Most importantly, special coding is used within the handout to assist students when using some of the suggested websites. The most interesting part of the handout is the embedded quiz of six questions that the student must answer before turning in the handout as an assignment. By the time this assignment is due, the students will have had at least two sessions in a class setting with the government documents librarian. During these sessions, the answers are provided.

The fifth handout section provides a step-by-step primer of how to find articles that go along with a topic of interest. In addition to class sessions, students are encouraged to use the “Book a Librarian” school resource to supplement their studies.--

The remaining portion of the carefully constructed handout created for the students includes tips and pointers added based on experience as students ran into challenges. See Exhibit B.

## CONCLUSION

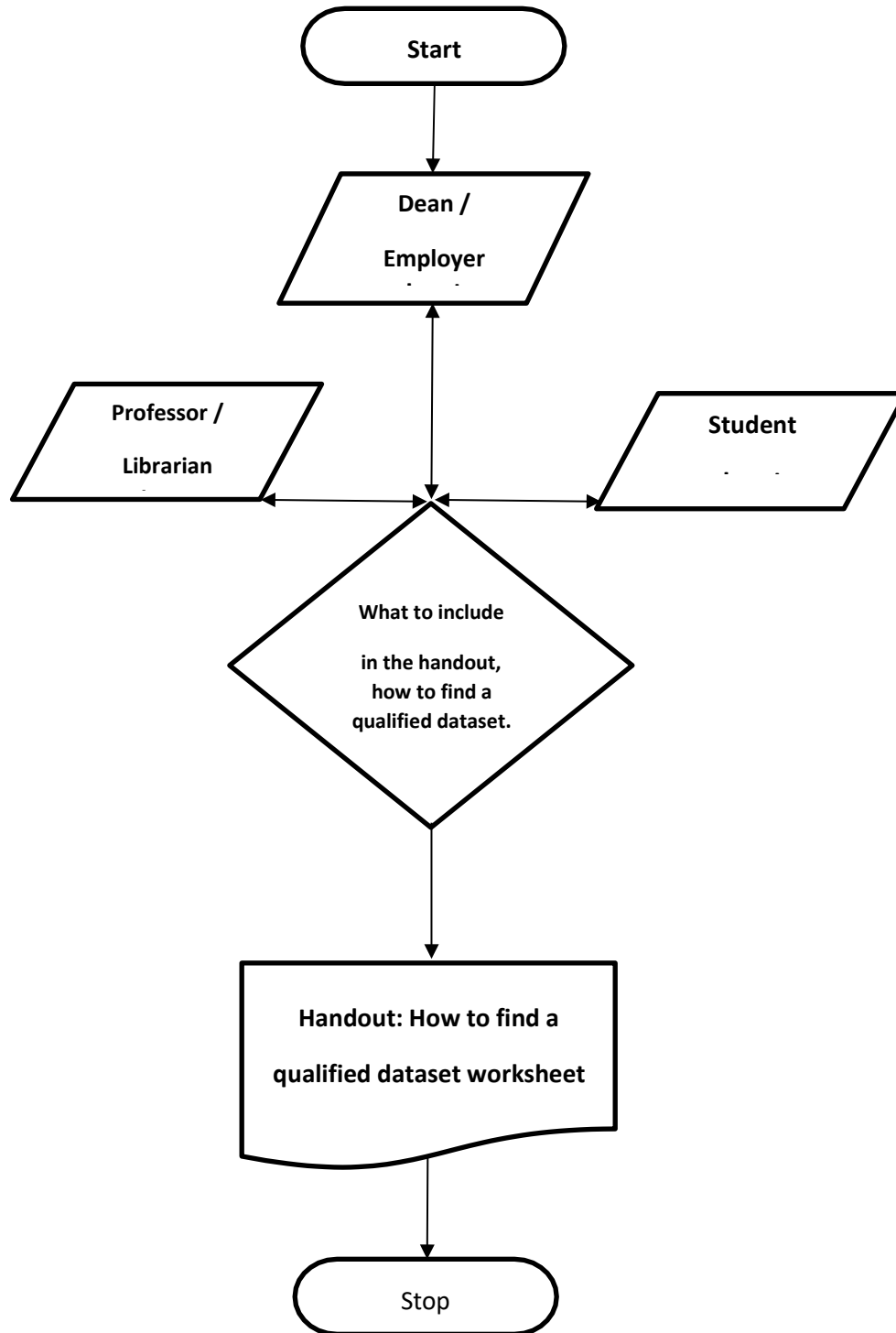
Students are instructed on what data is core to preserving the dataset's meaning and integrity. Students are coached on what data points can be retained or eliminated to form a unique research topic. With this training, students develop research topics for which they are passionate, which results in informative and interesting research papers. Students are taught to look at the data logically and intentionally, grouping data by geography, time frame, or other categories. The students demonstrate their critical thinking ability by deciding what parameters can be used from their dataset. Again, this skill is applied to their datasets, learned during the term before developing their research paper. The students are provided with a quick and manageable framework to help them decide what statistical measures are appropriate for their analyses. Students inform their audience about their topic using logical reasoning. These efforts are all about students producing creatively for their assignments, with a view to them becoming strong researchers and more creative individuals.

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## Appendix A: Worksheet Development Process for Handout



## Research Strategy 2022-23

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### I. Topic

1. What topic are you researching? Identify some search terms.

Topic: Recycling

*Example Search Terms:*

Recycling

Garbage Collection

Waste Management

Waste Disposal

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### II. List of Past Paper Topics

Homelessness

COVID-19

Sexually Transmitted Diseases

Education Attainment

Mental Health

Social Media

Public Safety & Crime Data

Drug use

Climate change

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### III. Best Sources for Datasets

Go to google data search <https://datasetsearch.research.google.com/>

Make sure you narrow your search by selecting download format **Tabular** and **Free**

- [data.world](https://data.world) (<https://data.world>)
- [kaggle.com](https://kaggle.com) (<https://kaggle.com>)
- [dataverse.harvard.edu](https://dataverse.harvard.edu) (<https://dataverse.harvard.edu>)
- [healthdata.gov](https://healthdata.gov) (<https://healthdata.gov>)
- [worldbank.org](https://worldbank.org) (<https://worldbank.org>)

Narrow by website in the Google Dataset Search.

1. *Example: homelessness site:data.world,*
2. *Example: homelessness site:Kaggle.com*

#### Locating Large Datasets

1. To locate large datasets, I would have the most luck trying...
    - a. The find articles tab in the Business Guide
    - b. the open web
    - c. a dataset dedicated search engine such as *data.gov*
    - d. searching the library stacks for reference books on population demographics
  
  2. To locate datasets on my topic I should... *Circle all that apply*
    - a. Limit to image and text files
    - b. Limit myself to free online resources
    - c. Limit to csv. files or "table" compatible files
    - d. Check the file type and size before downloading a file
-

3. What file type would be the most helpful?
  - a. PDF
  - b. .XLSX
  - c. Text file
  - d. JPEG
  - e. JSON
  
4. Which file size is most promising/ likely to help you with this project?
  - a. 3.3 MB
  - b. 1 KB
  - c. 44 KB
  - d. 95 KB
  
5. List three dataset search engines. (These engines are found on the datasets tab of the library guide.)
  - 1.
  - 2.
  - 3.

## Manual of Style and Citation

For this assignment, the citation style depends on your selected topic.

MLA- Projects focused on English, Literature, languages, and culture

APA- Projects focused on Social Sciences, business, or nursing APA

## IV. Finding Articles: Databases

Library Homepage > Research Guides tab > View Course Guides (This is located underneath the search box) > **BADM 299/298 Business Analytics** <https://library.usca.edu/298/299>

or <https://www.youtube.com/watch?app=desktop&v=Cj3YIVT44M0&feature=youtu.be>

See what kinds of results you get when you combine different search terms. **Email potential articles to yourself.** Start with *Academic Search Premier*, but feel free to explore other subject guides and databases that match your topic. For example, those with education topics could search ERIC and other databases in the [Education Subject Guide](#). As you search the databases, write down any major concepts or keywords you might use as search terms.

In the left-hand column, you can:

- Limit to peer-reviewed
- Limit to full-text
- Limit to by date
- Further refine your results and discover potential keywords/search terms using the Subject Thesaurus Term

If you see an article that looks promising:

- Read the abstract, and if you're still interested, email the article to yourself.
- Do not rely on the cite button to generate your citations. These are generally wrong.
- Use the "Permalink" button to get a stable URL if there is no DOI

**Accessing Resources (On and Off-campus)**- requires your email address and password.

**Some of you will select datasets that are TOO BIG that cannot be uploaded to Blackboard.**

**The key is this!**

**Once you have uploaded the dataset, test that you can download the dataset yourself and open it in excel.**

**If you click on the downward pointing arrow with the line under it (the download button), and the .xlsx or .csv file does not download for opening, then there is a challenge you must solve.**

**You have a dataset with records or rows or both that is too large for a successful upload into Blackboard or download for me to review. You must repair this situation.**

**You need a minimum of 800 records or rows and approximately not more than 2,000 - 2,500 parameters or columns. You need at least nine parameters or columns with at least five of the parameters or columns as numeric.**

**What you will have to do is decide what part of the dataset you want to concentrate on and work with for the final project.**

**Some BIG datasets are comprised of several smaller datasets.**

**Of the several datasets, you want to study each one of them and then select the one that is most interesting to you.**

**Also, select the dataset that meets the criteria (at least eight hundred rows and nine parameters [five of which are numeric]).**

**If the one you find that is most interesting is still too big, then copy a subset of the information that you want to use to a new datasheet.**

**Submit this subset. The validity of the dataset can be checked via the link that you submit in a word document for the data research assignment and the final project.**

**Explain in your upload what you did and why.**

**Explain why you find the subset interesting that you selected.**

# Building the Speaking Skills Required in Today's Workplace

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## ABSTRACT

How can we meaningfully teach the speaking skills needed in today's evolving workplace environment? Today's work environment ranges from traditional office settings to the newer hybrid work formats using digital tools. As artificial intelligence tools are entering the workplace, how does this change the role and importance of speaking skills? How do digital tools change traditional PowerPoint presentations?

This project's purpose is to study how to build the range of speaking skills required in today's evolving work environment. This paper explores how speech is currently taught in an undergraduate communication course. Recommendations are made for students, educators, and managers for improving the speaking skills required in today's work environment. Attention is now on the role of ChatGPT and artificial intelligence (Skrabut, 2023). A key principle in giving speeches is to know your audience (Hop, M and Moon, T., 2009). AI and digital tools such as online polling help with this key principle.

**Keywords:** public speaking, meeting management, guidelines for online presentations, digital tools for speaking

## INTRODUCTION

*"A presentation isn't public speaking... It isn't making a speech. It's a conversation. Only you're doing most of the talking. The trick is to understand that you are simply talking with your audience, sharing your thoughts. You're not arguing. You're not selling. You're having a conversation. You're giving them a gift." Peter Coughter, The Art of the Pitch, Chapter 1: Everything is a Presentation.*

There is a business imperative for educators to ensure their students are equipped to speak effectively. Oral communication and speaking skills are key competency for career readiness (NACE). Speaking in organizations requires that clear messages are sent from speaker to receiver. Noise and confusion are to be reduced. Many tasks use speaking skills: meetings, planning, working with customers, coordinating with co-workers.

Educators prepare a student to effectively speak via undergraduate speech courses that teach a wide range of skills, such as those used to deliver a report, speak extemporaneously, or make a presentation via a web seminar. The purpose of this project is to research how the business curriculum can build upon this speech course foundation and how to continue to build speaking skills. There are multiple skill sets drawn upon for effective speaking skills, including the following (NACE, 2019):

- verbal speaking
- non-verbal body language
- visual (reading/viewing)
- listening and hearing
- questioning
- emotional awareness and management of distractors

One question that business educators are now facing: How can we meaningfully teach the speaking, communication, and collaboration digital skills needed in today's workplace environment (Harvard Business Review, 2022)? Undergraduate speech courses teach a wide range of speaking styles such as presenting a report, extemporaneous speaking, and presenting using digital webinar formats (D. Gregory, 2022). In organizations, a manager is typically required to speak up in meetings, speak to customers, speak in teams, and speak informally (Cascio, 2022).

Organizations and managers have a responsibility to create work environments where employees can speak information clearly to their coworkers, supervisors, and customers.

## STATEMENT OF THE PROBLEM

What is effective verbal communication/collaboration? Why is effective spoken communication/collaboration important to a business? How is the paradigm shift in the business workplace (from brick-and-mortar to hybrid/remote models) impacting the oral communication/collaboration needs of the workforce? What are common barriers to effective verbal communication? These barriers are both systemic (for example, a poor communications culture in the company), or in the workforce employees (for example, poor communications skill sets of the communicator). How are business schools teaching oral communication skill sets at the undergraduate level? What can the business school do to enhance the fundamental verbal communications skill sets taught at the undergraduate level, particularly in light of the changing workplace environment? What are lessons learned for educators, workplace leadership, and employees concerning effective oral communication/collaboration?

The purpose of this paper is to begin to answer these questions and to start a conversation with students, managers and educators about the changing nature of oral communication in the digital workplace. The starting point for this exploration is lessons learned in a public speaking course.

### Lessons from a Speech Communications Course

Gregory (2022) introduces the goal of learning oral communication as progress as an ongoing process in which the individual seeks to improve their communication abilities. Gregory recommends overcoming student resistance and uncomfortable feelings when preparing to speak by setting a relaxed tone that includes a great deal of encouragement. She advises students that communication is a journey to improvement/progression in self-knowledge, self-confidence, and oral self-expression.

Gregory (2022) offers this guidance:

- Know your audience (Hop and Moon, 2009)
- Distill your message down to its essence
- Use everyday language
- Provide a brief introduction that engages audience
- Make eye contact/show enthusiasm
- Speak at an appropriate volume, and at a clear, good pace (usually slower than normal conversational speech)
- Few or no fillers such as ah, um, ya' know
- End with a brief summary/conclusion/call to action (if you are asking for action to be taken, state your request in a clear direct manner); "The ask" refers to the specific request at the conclusion of the presentation.

Gregory (2022) highlights two principles: 1. **Know your audience:** Take time to research your audience before your presentation for enhanced successful communication. Is it a presentation for the public or a specific company or group? What is the level of understanding in members of the audience (experts, generally acquainted with the subject, or novices on the topic)? What are the demographics of the audience? What other characteristics can you learn about your audience? What is the appropriate level of formality and possibly humor? 2. **Brevity/Keep it Simple/Manage Overload:** With information overload in today's workplace, clear and concise speaking is critical to success. Stay focused on topic; do not go off on an unrelated tangent. When the group conversation goes off, gently bring attention back.

Gregory recommends the assertion-evidence method for creating slide decks. This idea is to avoid bullet point lists. Rather, each slide contains a main idea. Due to today's audience distraction and short attention span, the Assertion-Evidence slide format improves communication through sharing ideas and information via applying the 3 simultaneous modes of voice, text and supporting visuals (pictures, charts, diagrams) and is effective for all presentation topics and fields/professions.

What are some of the different types of speaking in the workplace? Table 1 lists different types of speaking required in the workplace, ranging from formal presentations to speaking up in meetings to informal conversations. Examples of workplace tasks using these speaking skills are offered. Newer emerging digital tools are added to traditional

communication modes (Chakrer,2023). Note that the line blurs between speaking and writing: voice recordings can be translated into text messages; written reports can be made audible.

**Table 1: Types of Speaking in the Workplace and corresponding examples of workplace tasks**

<b>Types of Speaking Skills</b>	<b>Examples of Workplace Tasks using that type of speaking</b>
Talking person to person: Employee speaking peer to peer, supervisor to employee; employees speaking to customers	Traditional daily work tasks
Individual and group formal presentations	PowerPoint presentations
Texting, instant messaging in applications	College recruiting now using texting as a preferred communication method; instant messaging application in hospitals used to speed process
Short 3-minute presentations (the Elevator Pitch)	Present a new idea in meetings, introduce yourself
Asynchronous communication technologies include recorded presentations (recorded video message)	Cloud collaboration tools, project management software
Managing a meeting; as a participant, speaking up in Meetings	Face-to-face or online meetings
Private one-to-one meetings	Giving negative feedback, challenging conversations
Telephone Calls and conversations	Sales calls, project work
Microsoft TEAMS offers a walkie-talkie feature--- instant talk within an organization	Frontline workers coordinating important events

Table 2 highlights three useful communication frameworks and concludes with a new framework used in Microsoft Teams (2023). Managers can organize work communication using a threefold approach: 1. prepare for meetings (create a channel, a group of people for that project); 2. use digital tools during meetings such as calling in a new person to answer a question and file sharing; 3. post meeting follow-up (for example, share recordings and information). In summary, Table 1 highlights the types of speaking that are required for a full range of tasks in organizations. Going back to basic communication frameworks (see Table 2) helps to organize this digital transformation in communication.

### **RECOMMENDATIONS for EDUCATORS, STUDENTS, and MANAGERS**

The purpose of this paper is this collection of recommendations about building and improving speaking skills. Speaking skills range from formal presentations to speaking up in meetings to informal conversations. These recommendations are based on years of collaboration by the authors Berardino and D. Gregory in helping students practice giving presentations in business classes.

**Recommendation to Educators:** Offering students practice in speaking deserves more of our teaching attention. A broader conceptual map of speaking is offered (Table 1). The basic skills to speak up and share one’s relevant thoughts in meetings are highlighted and seen as valuable for career success. Soon, now, we will need to consider

how AI (artificial intelligence) changes speaking requirements. And how is technology able to replace human voice for some work tasks? For example, SUNY now uses automatic recorded phone messages for weather cancellations. One corporation uses AI chat as the first stop in technology problems. Future business managers will talk to machines and machines will talk to them.

**Table 2: Four Frameworks of Communication**

Push and Pull	Human Resource Information Systems makes a distinction between sending out emails (push) vs. having managers go to a dashboard when they need information (Johnson, Carlson, and Kavanagh, 2021)
Sender-Receiver	Classic communication model sees a message traveling from sender to receiver with noise for interference
NACE Career Readiness Communication Competencies	Clearly and effectively exchange information, ideas, facts, and perspectives with persons inside and outside of an organization. Behaviors include active listening, persuasion, and influencing skills; frame communication with respect to diversity and varied individual communication abilities, and cultural differences, and promptly inform relevant others when needing guidance with assigned tasks.
Digital Communication software applications such as Microsoft TEAMS	Communication Channels (customize different groups of employees and customers organized around functions); a framework based on communication as pre-meeting, meeting, and post meeting

Business professors can include speaking practice across multiple courses and practice small speech lessons each week. A simple assignment such as summarizing an article or talking about a current event can be added to courses. Educators need to check and ensure that students have basic knowledge of speaking and communication aspects required in work environments. Special attention is needed for students seriously nervous about public speaking. Students need safe opportunities to practice speaking skills. In giving feedback on presentations, rubrics can be used. The authors Dr. Berardino and Dorrie Gregory use a constructive feedback method of giving students one thing to improve on.

**Recommendations to Students:** One of the drivers of career success is the ability to communicate, get your thoughts and ideas across, and to be understood by co-workers, managers, and organization leaders. It is reasonable to expect that managers and the organization provide opportunities to speak and share thoughts and ideas verbally.

- Practice. Before giving a presentation, do a full rehearsal of the talk. One practice is to record this full rehearsal and review yourself. (This also provides a recording to share with those who cannot attend the talk and a file for a portfolio.)
- To the shy, quiet, reserved people: Speak up! A suggestion is to set a goal of speaking at least once per meeting. At the start of meetings, say something simple to warm up your voice and break the ice (DeVore K. and Cookman, S. 2022).  
A new practice in organizations is called “stand down, speak up” which instructs those people who have already spoken to listen to those who have not yet spoken. Another organization practice is to have a person in meetings dedicated to watching out for participants speaking over the quieter participants. Everyone in meetings can contribute to bringing in the quieter participants.
- As a participant, contribute and ask questions. At a minimum, introduce yourself during the icebreaker and say thanks at the conclusion. Fight Imposter Syndrome: *You’ve earned your seat in the room!* If you don’t understand something, ask.
- Observe presenters who model good communication skills. As you listen and attend presentations, consider: what do you admire, what works for you?
- As a speaker, part of your task is to manage the cognitive overload, knowing that people can only take in so much information.
- Use humor carefully, but humor is appreciated. For example, stick to mainstream cartoons such as those in the Wall Street Journal and The New Yorker.



- Use Silence. Silence is a response. Also, incorporating a momentary silence will allow your audience to absorb the information that you've shared. One example is when displaying a new PowerPoint slide, a brief silence before speaking gives the audience time to read and absorb the message on the screen so they may actively listen to your speech.
- When speaking, slow down. Repeat your main messages. Speak clearly, possibly speak louder.
- Avoid touching your face. Become more aware of your nervous gestures. (Record yourself and playback and you will see some of your habits.)
- On camera, check your background and what's in view. Check your lighting --- no bright sunlight/window with open shade, directly behind your head. Double check your own appearance.
- Possibly use a headset. Eliminate distracting background noises such as dog barking, phone ringing or buzzing, family conversations in a nearby room
- During video conference calls, keep the dog or cat off screen.
- Checklist approach. Start by doing a mic check "Can you hear me?" — A technical specialist taught this method.
- Define terminology and abbreviations immediately after first use. Be careful not to overuse abbreviations (specialized language). For example, a presentation repeatedly used LMS until someone asked, "what is LMS?" (Learning Management System).
- Don't waste the time of your audience. Attention span for watching a video recording is said to be 7 minutes (Pickett, 2023).
- To the shy/ reserved: make yourself speak up at least once in every meeting. Sometimes just working the voice, saying something easy, helps (DeVore K. and Cookman, S. 2022).

#### **Recommendations to Managers:**

- Remember that many people get nervous giving presentations and even speaking up in meetings.
- Create a culture that encourages open communication and speaking.
- Make time for small talk; when co-workers meet informally, make time for those informal conversations.
- Don't do 2 things at once, instead use "active listening".
- As a manager, watch out for over checking smart phone devices while talking to others.
- Value story telling.
- Organizations are now encouraging the use of microphones for speaking events to help people with hearing challenges (Mizaku, 2021); meetings are using methods such as "stand up, sit up down" to increase speaking from those who are reluctant to speak (those who have already spoken are instructed to be quiet while those who have not spoken speak up).
- Microsoft TEAMS method of organizing channels and using a simple communication framework of pre-meeting, meeting, and post meeting offers a fresh simple communications model.

#### **GOING FORWARD: SPEAKING SKILLS, AI, and DIGITALTOOLS**

History proves that the spoken word is powerful. ChatGPT search engine offers examples such as "Ain't I a woman" from Sojourner Truth in 1851 to "I have a Dream" from Dr. Martin Luther King Jr. in 1963 and much more. As AI (artificial intelligence) continues to expand, speech education becomes more important. The fundamental principle in good public speaking is to know your audience. Big Data can help us do just that. AI can clump audience member characteristics together and help us to better understand the people who are listening to us. Having this knowledge enables us to select appropriate messages that target the needs of each specific audience and derive an effective means of crafting a vibrant and engaging (human) presentation, whether delivered in-person or online (Graves, 2023). Understanding an audience helps manage information overload.

A simple practice used in online presentations is to build a word cloud with the audience entering words at [www.mentimeter.com](http://www.mentimeter.com) that show their current familiarity with the presentation topic. Instantly and visually, a word cloud is generated that expresses the audience's current understanding of the topic! For example, a SUNY Online presentation (Alexandra Pickett, 2023) asked participants to open their browser, go to mentimeter, enter a code, and answer: What is the key factor to successful online teaching? In 4 minutes, the presenter had a read on the current knowledge and experience of her audience.

We learned through the pandemic that humans crave human connection. Rapidly growing AI is a tool and can be useful in assisting us reach our goals of better communication with our listeners. The authors Dr. Berardino and Dorrie Gregory forecast that audiences will engage with and prefer human presenters more than an automated "human" consisting of AI. People are spending more time on their screens and not practicing verbal communication skills as the internet, AI and all-things-screen-related grow. This means public speaking education will be more in demand with more pressure to teach oral communication skills for the digital age.

## CONCLUSION

Business students need to be able to articulate their ideas clearly, to make presentations at work, and speak with peers, supervisors, customers and others. People in business need to be able to speak clearly on the phone, introduce themselves, and participate in meetings. Communication models teach how to create a clear message and avoiding misunderstanding noise in the relationship between sender and receiver.

As a powerful example of the danger of miscommunication, it is possible that the space shuttle Columbia Challenger disaster was in part due to a poorly designed PowerPoint slide. (This was included in a SUNY Poly presentation on how to improve science presentations.) The downfall could be attributed to a technical communication failure; scientists had information, but that information did not get communicated so that actions could be tried.

Business students need to place value on learning speaking skills required in daily work settings. Building these speaking skills requires steady practice. As a manager, speaking and clearly communicating is a part of management responsibility. Lives can depend upon it. In the daily overload of information coming at us, there is no room for the confusion of unclear messages.

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# **Technology Agility and Soft Skills - A Unique Duo for CPA Evolution and Advancement of the Accounting Profession: How a Small University Tackled the Challenge**

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## **ABSTRACT**

The accounting profession and accrediting bodies are expecting today's graduates to not only be technologically competent and well versed in the use of emerging technologies, but also to possess the "soft skills" necessary to enter and succeed in the profession. The job of preparing accounting students for this role falls to the faculty and the universities. A major challenge now faced by faculty and universities is how to introduce emerging technologies and soft skills into an already overburdened curriculum at a time when enrollments and resources are declining. This paper provides insights to accounting program leaders and faculty members by describing the approach an AACSB accredited accounting program, at a small university, took to meet this challenge.

**Keywords:** CPA Evolution, professional development, technology agility, soft skills, accountants

## **INTRODUCTION**

A primary responsibility of accounting educators is to ensure that graduates possess the necessary skills and competencies to enter and succeed in the profession. To accomplish this goal faculty must design curriculum that is both current and relevant. Accounting programs have traditionally been considered professional degrees with an ideal undergraduate curriculum that prepares students to enter the workforce immediately following graduation. Many such programs also aim at preparing students for professional certifications and licensures such as, but not limited to, the Certified Public Accountant (CPA), the Certified Management Accountant (CMA), and the Certified Internal Auditor (CIA). Given that the accounting profession is considered a "learned profession" (Aldredge, Rogers, & Smith, 2021), accounting differs from other traditional business school programs in many ways. The most notable example is the CPA licensure 150-credit hour and continuing professional education requirements in all U.S. jurisdictions. These requirements reflect the profession's self-identity that CPAs need continuous, lifelong learning in order to guard the public interest. Most professional societies and major CPA firms also believe that a well-rounded accounting professional should be equipped with "soft skills" in addition to technical and professional skills. Although there are different definitions for the term soft skills, research supports that accounting graduates should have the ability to communicate, work well in teams, be comfortable in a professional setting, and possess a customer-service mentality and skills (Tan & Laswad, 2018).

In addition to professional development or soft skill development, recent employer reports (PwC, 2015; KPMG, 2017) and industry publications (Sithole, 2015; Pan & Seow, 2016; Lee, Kerler, & Ivancevich, 2018) have focused on new and emerging technologies that affect how businesses are run. Many industries have witnessed the disruptive power of emerging technologies. Professional service firms have also noticed this trend with many rolling out a number of different up-skilling programs for their staff emphasizing emerging technologies. Artificial intelligence, robotic processing automation, blockchain, machine learning are just a few examples of emerging technologies that accounting professionals now utilize and embrace in their workplace. With more and more repetitive tasks being performed by technology, now more than ever accounting professionals must be attuned to the use of emerging technologies so that they can exercise their professional judgement and add value to their client work. For this same reason, major accrediting bodies have increased their expectations regarding the knowledge and use of technology. For example, the Association to Advance Collegiate Schools of Business (AACSB) finds technology competency of such importance that it now includes very specific standards related to technology. According to the AACSB, curriculum should be designed to ensure that "current and emerging technology is appropriately infused throughout each degree program" (AACSB, 2022). The separate standards for the specialty accounting accreditation take it a step further and state that accounting degree programs should "include learning experiences that develop skills and knowledge related to the integration of information technology in accounting and business.... this includes the ability

of both faculty and students to adapt to emerging technologies as well as the mastery of current technology” (AACSB, 2018). In standard A5, AACSB recognizes the importance of new skills development for the accounting professionals, and requires accounting programs to incorporate learning experiences that develop skills and knowledge related to the integration of information technologies.

## CPA EVOLUTION

With the rapid infusion of emerging technologies into all aspects of business operations, the expectations for today’s CPAs are very different than in the past. Recognizing these differences, the National Association of State Boards of Accountancy (NASBA) and the American Institute of Certified Public Accountants (AICPA) addressed, in a joint initiative called the CPA Evolution, the increasing need by the profession for graduates to possess advanced technological skills and knowledge. Upon implementing the CPA Evolution’s proposed revisions to accounting program curricula and the uniform CPA exam, newly minted CPAs will be equipped with advanced technological skills and knowledge. In addition to critical thinking and problem-solving skills, the profession now desires graduates to understand business systems, controls, data management and analysis.

NASBA and the AICPA utilized feedback from over 3,000 stakeholders including faculty, students, and firms in a variety of industries. Through their joint research they found that accounting firms are not getting the type of talent that they need and this is affecting their hiring practices. The accounting profession is now seeking graduates with a different set of competencies than those that have historically been developed through traditional accounting programs, especially competencies related to technology. As a result, firms are meeting their staffing needs by hiring non-accounting graduates who possess the desired technology competencies in place of graduates from traditional accounting programs. This conclusion is also supported by the 2017 and 2019 AICPA Trends Report that showed that firms hired 19% fewer accounting graduates in 2016 when compared to 2014. In 2018 this number increased with 29% fewer accounting graduates hired when compared to 2014. The objective of the CPA Evolution initiative was to “transform the CPA licensure model to recognize the rapidly changing skills and competencies the practice of accounting requires today and will require in the future” (AICPA, 2021). This initiative represents the largest overhaul of the licensure model and is the accounting profession’s response to a technology-driven marketplace. The new model includes a common core and allows students to select from one of three discipline tracks: Business Analysis and Reporting (BAR), Tax Compliance and Planning (TCP), and Information Systems and Controls (ISC). The common core represents the basic knowledge and skills that new CPAs are expected to have, which include accounting, tax, and auditing. The remaining component – disciplines – represent a specialized area in which a new CPA can choose to focus. Each discipline represents a deeper understanding of the specialization that reflects the realities of practice.

Given the notable skillset gap and shortage of traditional accounting graduates, many service firms are making up for this deficit by hiring graduates from non-accounting backgrounds with data analytics and information systems expertise (AICPA, 2019). If accounting programs do not want this trend to continue, steps should be taken to revise accounting curriculum to develop the knowledge and technology skills desired by the profession. Given the technological advancements in the accounting and finance professions, the NASBA and the AICPA decision to add the ISC discipline track is no surprise. As a matter of fact, the industry applauds the decision and the move to include more information systems knowledge and skills assessment on the CPA exam. Adding the ISC discipline track will prepare future CPAs to be more technology savvy which is a must for today’s professionals.

These new expectations from the profession present significant challenges for faculty and business schools throughout the world. Accounting students already need to have a thorough understanding of financial accounting, managerial/cost accounting, taxes, auditing, and business law. With an already overburdened curriculum, how should accounting programs be revised to develop these additional skills and meet the expectation of the profession? In addition, it will be challenging for most accounting programs to acquire the necessary resources to make these changes given that more than half (54%) of accounting faculty nationwide reported a decline in accounting enrollment (Coffey, Conrad, Hinson, & Taylor-Morris, 2021). This challenge is especially great for smaller institutions already facing serious resource constraints<sup>1</sup>. Results from the AICPA Gap Analysis demonstrate that small institutions are the least prepared to make these changes. On average, only 36% of smaller institutions reported that their curriculum covers ISC topics, compared to 46% medium sized institutions and 51% large institutions. Most institutions feel that they are not prepared to offer an ISC track.

When it comes to integrating technology into the accounting curriculum, the first reaction of many may be to incorporate the use of spreadsheets because spreadsheets are a tool that accounting professionals utilize the most. Most

accounting professionals would agree that a proficiency in the use of Microsoft Excel or similar spreadsheet applications is a must-have skill for entry-level accountants. However, infusing current and emerging technology into a program goes far beyond spreadsheet applications. Also, technology agility does not depend on using any particular software application. NASBA and the AICPA made it very clear that they are not endorsing any specific software application but rather the development of generic digital skills and the ability to learn, apply, and utilize technologies in business and accounting tasks. According to AACSB the emphasis on emerging technologies is recognizing the need for continual learning of new skills needed by accounting professionals.

AACSB supports technology competency in the accounting curriculum, however, it does not dictate how the integration should be implemented. Accounting programs may design and customize their own technology infused curriculum that aligns with their mission and strategic plan, keeping in mind their available resources and student demographic profile. The integration may be incorporated across all accounting courses or encapsulated in a module or a course (AACSB, 2014; Sledgianowski, Gomaa, & Tan, 2017). The objective of this article is to describe an approach to infuse accounting curriculum with technology agility and soft skills. The approach should provide insights to accounting programs that are in search of a means to integrate these skills in their curricula.

## **A SOLUTION**

The institution at which the authors serve is a small, private university that was recently awarded the AACSB specialty accreditation in Accounting. The accounting department at this institution has more than ten full-time faculty members who teach courses in the areas of accounting, taxation, and business law. The university has a reasonably sized accounting program however, it is experiencing the same challenges to maintain enrollment that many other higher education institutions are currently facing. These challenges were made more severe by the disruptions caused by the COVID 19 pandemic (Kim, Krishnan, Law, & Rounsaville, 2020; Neuwirth, Jovic, & Mukherji, 2021). The declining enrollment experienced by this institution has severely limited the accounting program's ability to quickly and easily modify the curriculum in response to the expectations of the profession. Even though the program has healthy relationships with the area's accounting employers, the challenges of equipping accounting students with professional development and emerging technology skills, and embracing the new CPA licensure expectations, are a significant hurdle to moving the program forward. However, the faculty's desire to provide a professional education and prepare students to be career ready lead the department to an innovative approach to overcome that hurdle by creating a one-credit course titled, "Seminar on Professional Accountancy and Emerging Technologies." This course is designed as a co-requisite to the first "gateway" accounting course that all accounting majors are required to take. Most accounting majors take the gateway course in their sophomore year which is also the time when most are exploring their first professional internship. Requiring the one credit seminar course at this time provides students with the opportunity to learn emerging technologies and develop professional- soft skills at the most advantageous time.

As the title suggests, this course has two distinct but related components: professional development and emerging technologies. In a regular 15-week semester, students are required to participate in at least 15, one-hour workshops that cover a variety of professional development and emerging technology topics. The format of these workshops is either in-person (classroom) sessions, online (webinar) presentations, or self-study modules. The content of the individual workshops is independent of the others however, all workshops have the same objective, i.e. to develop skills necessary to prepare students for professional careers in accounting. Examples of workshop topics include: resume writing, networking, job interview preparation, creating a professional online presence, blockchain, artificial intelligence, and the introduction to various software tools used in the profession such as advanced Excel, Power BI, Tableau or Alteryx.

The workshops are offered in a "buffet" style with typically, 25 - 35 emerging technology and professional development workshops offered during the semester from which the students can pick and choose whatever workshops meet their needs to develop a particular skill. This paper reports the experiences of students and faculty from the first offering of this one credit seminar course. All students were required to take the first module of the course and in this module, students were provided with an introduction to the course and the remaining modules that were to be offered. After completing the first module students were permitted to select from any of the remaining modules available to meet the minimum number of credits required. Each semester the course is reviewed and the requirements are reevaluated based on student and faculty feedback. This review has resulted in reclassify many of the modules as required. In addition to participating in a minimum number of workshops, students are required to satisfy the unique requirements of each workshop to earn course credit. Typically, the submission of a reflection report from a workshop is mandatory for students to earn credit. For virtual workshops, students provide evidence of attendance, which can

be in the form of pictures or screenshots. In addition, the reflection report requires students to delineate their main takeaway from the workshop, the information that they learned, and how it will help them in their future career. There are no exams or tests administered in the course. The grades are assigned based on the number of credits earned from workshop participation. The minimum number of credits required to earn a specific letter grade is specified in the grading scale.

The biggest challenge with offering a “buffet” style course was to identify a sufficient number of workshop topics that can satisfy a variety of customer appetites. To address this challenge, the department sought input and help from employers and professional societies. Employers were asked to participate in the design and delivery of the professional development and technology modules. General guidance was provided by the faculty but the employers were permitted to select the content for each module. They were asked to choose the professional development and/or technology skills that they would want their employees and new hires to possess. Employers were eager to participate in identifying topics and also in developing and delivering workshops. This mutually beneficial arrangement gave employers the opportunity to provide service to the profession while at the same time providing them with access to potential new hires. Typically, students in the seminar are just starting to explore career opportunities in accounting. Participation in the creation and delivery of the workshops afforded employers the unique opportunity to identify qualified, promising candidates and attract those candidates to their firms. For employers, the minimal cost of offering a workshop, i.e. preparation and speaker time, was well worth the potential benefits of increased brand awareness and access to students early in their academic careers.

In addition to employer assistance, many professional societies offer online webinars that introduce faculty and students to various emerging technologies used in the profession as well as professional development topics. Also, some large service firms regularly create and share free educational webinars. The department made use of this no cost resource by including these webinars in the “buffet” of workshop offerings.

Finally, recognizing the potential untapped resources of the university faculty and professional staff, the campus community was invited to participate in the development and presentation of the workshops. The expertise and skills brought to the project by this group further enriched the workshop content and offerings.

## **LESSONS LEARNED**

Since the initial offering of the one-credit course, “Seminar on Professional Accountancy and Emerging Technologies, the accounting department has received a good deal of constructive feedback and encouragement from employers, students, and its accrediting body. Among the favorable outcomes was that some students participating in the course were hired to specialized practice areas because employers made workshop presentations about those areas. In addition, the planning process for the workshops in the course supports the department’s effort in implementing AACSB’s standard A5. The standard suggests that the subjects of evaluation of the technology skills development in the accounting departments are not only the students, but also the faculty. A recent study reports that the biggest challenges in the implementation of the AACSB’s technology skills related standards are shortages of qualified faculty and funding (Andiola, Masters, & Norman, 2020). Several of the technology workshops in the course were presented by the accounting faculty members. Each of them voluntarily prepared themselves by attending the relevant training for the various software. In the process, some of the faculty successfully earned the certifications offered by the software provider. Thus, the course brought positive influence in developing qualified faculty to teach prominent technology skills to students.

In order to assess the impact of this new course on students, a survey was administered at the end of the semester. No points or extra credit were awarded for the completion of the survey. Students were informed that completing the survey was voluntary and that their individual responses would be kept anonymous. The objective of the survey was to gauge students’ perceptions pertaining to the course. The survey used a 5-point Likert scale ranging from 1 as strongly disagree to 5 as strongly agree. The survey consisted of 22 questions measuring the students’ perceptions of the emerging technology and professional development workshops and 8 questions gathering student demographic details. The survey responses reflect students’ overall perception of the course not the individual modules. The same survey questions were asked of all students regardless of the modules they completed.

The results of the survey show that students have a positive perception of the course and its effects on the development of their soft skills. Survey results indicated that students felt that the course expanded their knowledge related to the field of Accountancy (mean responses = 4.77) and paths to different accounting fields and careers (mean response =

4.54). With regard to professional soft skills, students felt that the course exposed them to career-search (mean responses = 4.85), career-development tips (mean responses = 4.69) and that the course delivered on how to build and improve their networking skills (mean response = 4.54). The survey results also show that the course helped introduce students to professional accounting organizations (mean response = 4.77).

With regard to emerging technologies, the survey results show that students felt the course expanded their knowledge of emerging technologies used by the accounting profession (mean responses = 4.62), and helped them to recognize the demand and the importance of data analytics skills (mean response = 4.62) and the technical agility to the Accounting profession (mean response = 4.54). Results also show that students are aware that the profession will require them to continuously update their knowledge and skills in data analytics (mean response = 4.69). In addition, the course identified the resources provided by the analytics tools and/or technology featured in the workshops (mean response = 4.54).

The survey also offered students the opportunity to provide input and share their recommendations, concerns, and ideas about the course in general. The following are several notable comments provided by students on the survey:

“I thoroughly enjoyed the paths that were outlined through this course and believe it was beneficial. It helped expose students to technology and career paths they would not have discovered otherwise. Thank you!”

“The improvement that I would recommend is to ask everyone their schedule so that the classes that are scheduled for Course Units can work with everyone’s schedule; that way everyone can attend.”

“Impressed, but a little too demanding.”

“I think the information covered in this course is extremely useful. It was really interesting to learn more about technology and accounting jobs.”

“At first, I was not a huge fan of taking this course, but I grew to like and appreciate it. I think that in the future this class would be a good co-requisite to have with Intermediate Accounting 1 because of all the valuable information you learn in all the workshops.

“I really enjoyed this course. It helped me to better understand my options in accounting.”

“The networking aspect of the course was by far the most helpful thing I’ve done in school yet.”

“I found this class to be a great opportunity to further my knowledge of the accounting field. I found that writing the reflections helped me to better retain the content from the various workshops and seminars. I also thought the workload was appropriate for 1 course credit.”

“I also liked the opportunity to get to know some professors I will have in the future. I think taking this 1 credit course alongside Intermediate Accounting I is a good placement because it is late enough that I am familiar with the field through my previous classes, but early enough that it is still beneficial in my job/internship search.”

“Thank you for providing the opportunity for me to take this class! I found it very beneficial!”

There was no formal mechanism used to gather feedback from employers. However, informal feedback was provided from the employers who participated in developing and delivering the module content.

## CONCLUSION

The objective of this paper is to provide insights to accounting department leaders and faculty members by sharing the approach a small, AACSB accredited university with the specialty accreditation in Accounting, took to integrate emerging technology and professional development “soft skills” into their accounting curriculum. In addition, a way to tap into the resources offered by the professional community to help with this integration is also provided. The following are the key takeaways from the approach taken by this university:

- Accounting programs may not have to design or develop all content from scratch. Take advantage of existing resources and use them as your ally. For example, most schools have professional staff in a career center or in other related student services departments who can provide assistance. These professional staff have the knowledge and skills that can help students with general career-readiness skills. Collaborating with existing programs or resources would be a more efficient way to encourage students to explore professional help to be ready for their professional internships.
- Academic silos do exist but that shouldn't be an obstacle to equipping accounting students with sought-after technology skills. Accounting department/programs may consider working with another school or department within the university to offer classes that cover areas traditionally not covered by accounting faculty.
- An objective of the seminar described in this paper is to raise awareness of the students that there is a demand from the profession for them to develop technology agility and soft skills. The workshop should provide them with initial exposure to technologies that are currently utilized by accounting professionals and identify available technology and software tools.
- The structure of the seminar can be adapted and customized accordingly. Accounting programs may use the seminar format to provide initial exposure to students about the demand in technology agility and soft skills. The programs may then continue to strategically infuse its curricula with the skills in an advance accounting course setting.
- Using the seminar as a platform to bridge the professional community with the student body is a strategy the benefits all parties. Inviting employers to come to campus to share and demonstrate the technology used in practice allows students to be exposed to the latest industry trends, while at the same time the platform gives potential employers an opportunity to put their firms in front of students. In today's environment where everyone is competing for talent, this is a win-win situation.
- Many professional service firms offer educational resources such as cases, free webinars, and event short training courses that are ideal candidates to be part of the "buffet" offerings. Emerging software tool companies usually have well-designed learning materials that can be used in class or as stand-alone self-study materials for students to learn about new tools, usually at a very low cost or even for free. These resources are great addition to the "buffet" offerings as well.

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1 This paper does not consider the economic factors that impact university enrollment or choice of major. The primary purpose of this initiative was to help ensure that those students who choose to major in and pursue careers in accounting possess the professional development and technology skills necessary to be successful in the workplace.

# Using Gaming Applications to Teach the Four Ps of Marketing

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## ABSTRACT

Learning how to apply and use the marketing mix – or the four Ps – is foundational to a Principles of Marketing business course. Traditional learning methods rely on reading, memorization, and the classification of activities into the appropriate “bucket” – product, price, promotion, or place. Modern teaching methods should expand beyond traditional means by incorporating technology into the learning process. Research has shown that the use of technology not only increases the level of excitement to learn, but also the level of engagement at which students participate in learning. The purpose of this paper is to describe an active learning activity that was introduced to a group of 34 students enrolled in a hybrid, 100-level marketing course in spring 2021. Overall, aggregate feedback from the marketing mix activity indicated that students enjoyed the learning experience and found it to be a welcome change from standard assignments. Not only did student comments show congruence with the learning objectives, but also the average grades for the marketing mix activity ranged from 3% to 10% higher than the quiz averages, further supporting research that experiential learning improves student performance.

**Keywords:** principles of marketing, marketing mix, four Ps, experiential learning, gaming applications, higher education

## INTRODUCTION

As pioneers in the field of marketing, Philip Kotler and Sidney J. Levy (1969) defined marketing as “the function of the organization that can keep in constant touch with the organization’s consumers, read their needs, develop products that meet these needs, and build a program of communications to express the organization’s purpose” (p. 15). This definition, though semantically evolved, has remained nearly unchanged for over 50 years. At its most basic, marketing is about an exchange between two parties that results in a transaction of physical products, services, or ideas (Kotler & Levy, 1969); however, the scientific side of marketing involves the observation and classification of facts that guide actions toward a predicted result (Borden, 1984).

As the marketing concept evolved, academics and practitioners considered consumer behavior to be central to understanding humans and their response to the stimuli to which they are subjected (Borden, 1984). To that end, a variety of theories, models, and concepts grew in popularity and became instrumental to the curriculum of marketing education. Today, the marketing mix is ubiquitous to marketing. Introduced into lexicon by Neil Borden in 1953 in an American Marketing Association speech, the marketing mix was later defined as the *four Ps* by E.J. McCarthy in 1964 (Dominici, 2009). McCarthy’s version, aptly named the *four Ps* due to its managerial focus on product, price, place, and promotion, provided the context by which managers would leverage these Ps to satisfy market needs (Dominici, 2009).

Modern marketing texts continue to present the four Ps as the marketer’s strategic toolbox of interrelated decisions and consequent actions used to create a desired response among a set of predefined consumers (Kotler & Armstrong, 2023; Solomon, Marshall, & Stuart, 2020; Grewal & Levy, 2020); hence, a thorough understanding of its use and application in business is fundamental to student learning at the principles-level and beyond.

This paper highlights a marketing mix activity that was issued to a group of 34 undergraduate students in a Principles of Marketing class in spring 2021. Due to the hybrid format of the class – both in-person and online – the activity was created as a means to enable students to work remotely using online tools, such as a gaming application (ie. Sally Spa and Cooking Fever) and a learning management tool (ie. Canvas), to plan and implement a business strategy in the context of the four Ps – product, price, promotion, and place. This paper contributes not only to experiential learning, but also highlights a multi-modal teaching method – synchronous and asynchronous – for the four Ps of marketing.

## TECHNOLOGY AND EXPERIENTIAL LEARNING

Experiential Learning Theory (ELT) is named after its emphasis on experience being central to the learning process (Kolb, Boyatzis, & Mainemelis, 2001). It is believed that this type of learning has an advantage over other types of learning due to creating higher levels of motivation, as well as improved retention of knowledge (Wilkinson & Jones, 2017). In addition, experiential learning is considered to be a lead indicator of learner success (Groccia, 2018).

The book, *Experience and Education* (Dewey, 1938), serves as a foundational piece of literature when discussing experiential learning (Roberts, 2003). Dewey (1938) believed that there was an intimate and necessary relationship between the process of actual experience and education. Modern literature provides many examples of pedagogical tools that can be used for engagement (James, Humez, & Laufenberg, 2020) including, but not limited to, gamification, project-based learning, active learning, group work, and simulations.

While student engagement has become a focal point to enhance learning, it has also been integral to improving teaching methods (Groccia, 2018). Dewey (1938) argued that traditional education has a "pattern of organization" that consists of schedules, rules, and procedures, which inhibit student learning (cited in Roberts, 2003); therefore, the challenge for educators is to foster learning in a way that allows new knowledge to be explored through the application of prior knowledge (Wilkinson & Jones, 2017). Incorporating technology into the learning process is a great way to balance organization and application of information.

The first digital natives entered the higher education systems over a decade ago and their expectations about learning have transformed the modern classroom (Lawter & Garnjost, 2021). As expert users of laptops, tablets, and smartphones, students engage in a much higher level of social sharing than prior generations, creating a shift in the faculty-student relationship from teacher-centered to learner-centered (Lawter & Garnjost, 2021). As cited in Haywood and Newman (2016), instructors are increasingly using games in business courses because they increase the student's ability to recall factual knowledge (Hoffjan, 2005) and provide a way to actively engage students where it is critical that students understand and recognize concepts at work in the real world (Jaijairam, 2012).

While preferred by students, experiential learning requires an additional level of planning and preparation for faculty. Games and simulations not only provide the means for faculty to create a connection between learning and doing, but also can serve as a dynamic learning tool when careful consideration is given to planning and implementing its use. Supported by these theoretical underpinnings, the marketing mix class activity was introduced.

## LEARNING OBJECTIVES FOR THE MARKETING MIX CLASS ACTIVITY

The overall goal of the marketing mix class activity was to give students the opportunity to engage in active learning by applying the information learned about the four Ps – product, price, promotion, place – to the operation of a new business via an electronic game. Comparable to a simulation, a decision-based game enables students to understand the impact that each business decision has on short- and long-term outcomes. The compounding nature of decision-making in the game allows students to organize, plan, and adapt based on the successful or unsuccessful outcomes of their decisions. In the marketing mix activity, each decision created an opportunity to identify new products, improve customer relationships through service and promotion, manage time and workload, and ultimately, to make money to reinvest in the business.

After completing the marketing mix activity, it was postulated that students would be able to:

- Demonstrate understanding of the marketing mix
- Apply the concepts of product, price, promotion, and place to the growth of the business
- Connect the facets of the marketing mix to simulated, real-world consumer experiences
- Engage in fun, active learning that aids in understanding and recall of the topic

## INSTRUCTIONS FOR EXECUTING THE MARKETING MIX CLASS ACTIVITY

Prior to administering this assignment, faculty should inquire with students about their access to a smartphone, tablet, or other device that allows them to download one of the suggested gaming apps from an App Store. Preferably, the game selected should require little to no investment. At the time the marketing mix activity was administered, the selected games offered both lite (free, with limited functionality) and full versions. It is recommended that faculty be

well-versed in gameplay and confirm that the lite version of any game offers enough functionality for the students to adequately complete the assignment. The most effective game for this exercise enables students to build a business and make decisions that impact both the short-term outcome for each round of play and the long-term viability and success of the business as a whole. In addition, the game needs to offer decision factors that can be easily assigned to the categories of product, price, promotion, and place.

After testing the games and confirming access to the necessary technology, students were provided an overview of the assignment and were asked to download one of the following games: *Sally's Spa* or *Cooking Fever* (Appendix A). These games were chosen because each offers students a different context for learning (a spa versus a restaurant), yet each has similar short- and long-term outcomes relating to time management, customer satisfaction, decision-making, purchasing and reinvestment, and promotion via environmental stimuli. The following steps highlight the administration of the activity.

### **Step 1: Review the Assignment (DAY 1 – In Class)**

Students were provided the assignment (Appendix B) and how participation for each section would be measured.

Grading elements for the activity were as follows:

- Canvas Journal – 80 points total
  - Daily Posts with description – 35 points
  - Marketing Mix Analysis – 25 points
  - Critical Thinking (Thought provoking to-do items) – 20 points
- Executive Summary – 20 points
- Assignment Total: 100 points

Based on the two games vetted by the faculty, students were asked to visit the App Store to research each game and select one to use for the marketing mix activity. Students were advised that the game should be downloaded on a preferred device to which the students would have regular access for the next seven to eight days.

### **Step 2: Learn the game (DAY 1 to 2 - Asynchronous)**

After the activity was introduced in class, it was recommended that students take one day to learn the game, including how to play, scoring, and measures of success (how to “win” the game). While learning how to play the game, students should identify any problems or needs that might be encountered throughout the business journey and make note of ways in which they could be mitigated. Students were asked to report these initial thoughts in their Canvas journal as a benchmark for the work over the next five days.

### **Step 3: Launch the game (DAY 2 to 6)**

Students were asked to play the game for a minimum of 20 minutes each day for the next five days. After each round of play, students were asked to make an entry in their Canvas journal that addresses the following:

- Outline key decisions that were made in terms of the marketing mix (4Ps)
- Report about the impact of those decisions on the daily business operation - positive or needs improvement
- Track daily customer count and sales (coins / money) to monitor growth or decline
- Identify “to do” items for the next round of play – categorize them into the 4Ps
- Briefly explain how these to-do items are expected to improve sales / store operation

An example of a student’s five-day journal entry is shown in Figure 1.

### **Step 4: Executive Summary (Day 7 to 8)**

At the end of the marketing mix activity, students were asked to prepare a one- to two-page, executive summary of the business journey. Specifically, students were asked to report on the following:

1. Which facets of the marketing mix did you employ most frequently? Rank them in descending order.
2. For the one used most frequently, explain why it had the most impact on your strategy.
3. For the one used less frequently, explain why it did not command a bigger role in your strategy.
4. Overall, what did you learn about the application of the marketing mix from this activity?

### Step 5: Submission (Day 8)

Students were asked to upload the Executive Summary to Canvas where each aspect of the marketing mix activity could be reviewed for content and grading. A sample of the Executive Summary can be viewed in Appendix C.

### Figure 1: Marketing Mix Activity Student Example (Canvas Journal)

**Day #1:** Reoccurring problems: Customers only have a certain amount of “patience wait time” before they become irritated at their order not being ready. I am probably going to lose customers when it gets really busy and I am not able to serve them all quick enough. It is very obvious my cooking appliances won’t cook all the food fast enough to serve every customer on time. I need to make enough money each level to be able to pay to upgrade all my machines and cut down cook time. On day 1 of playing the game, I made it to level 2 and gained an achievement of serving a customer.

**Day #2:** On day 2, I upgraded my cola dispenser and hamburger tabletop, then started level 2. At the end of the level I made 50 coins (price because they are paying me a certain amount of money for the food) and 4 gems. Now that I upgraded my cola dispenser, it is much faster so I always end up serving the people who want cola first. I still only have one pan to cook burgers (product) so it is very slow. After level 3 I had served 10 customers and made 150 in earnings. At the beginning of level 4, hotdogs were introduced (product). Things got a bit more stressful as I had focus on making both burgers and hotdogs, instead of just burgers. I upgraded and got myself an extra pan to make burgers. On level 5, the extra pan really helped get customers who wanted burgers out of the restaurant quickly. By the end of level 5, I had served 13 people and made 185 (coins) in earnings. Before I started level 6, I upgraded my burger patty meat and the game introduced upgrading the restaurants (place) interior. I bought 1 TV to keep customers occupied while they’re waiting (promotion). At the end of level 6, I had served 15 people and made 227 (coins) in earnings. Tomorrow I plan to try to upgrade my hotdog pan and my cola (product).

**Day #3:** On day 3, before I started playing, I upgraded my food warmer to two and got another hotdog (product) pan. I then began level 7. At the end of the level I had earned 241 coins and served 15 customers. Before level 8, I upgraded my ketchup (product) and the game introduced the option of putting ketchup on the hotdogs. Then, the game made the sports bar and bakery available. At the end of level 8, I had made 260 (coins) in earnings and served 14 customers. Before I started level 9, I upgraded my hotdog tabletop so I can serve two at once. At the end of level 9, I earned 268 coins and served 16 people. At the end of level 10, I made 282 coins and served 16 customers. Before starting level 11, I bought bar stools for the restaurant (place) and upgraded my burger buns (product). During level 11, the game introduced lettuce (product) to put on the burgers. At the end of level 11, I made 294 coins and served 15 people. I stopped here for the day. When I was finished, I had completed the tasks of upgrading my hotdog pan to level 1, used up a gallon of cola, and served 5 meters of sausages. Tomorrow I would like to try and complete the tasks of upgrading my cola to level 1, purchase one upgrade that increases tips, and serve 2 colas in 7 seconds.

**Day #4:** On day 4, I started on level 12. At the end of the level, I had earned 309 coins and served 17 customers. For the first time, I burnt my food and was deducted 5 points. I upgraded my cola (product) to level 1 before starting level 13. At the end of level 13, the game made the gourmet restaurant available while also letting me know that I made 306 in coins and served 16 people. Before starting level 14, I upgraded my sausages (product). At the end of level 14, I made 316 in earnings and served 16 people. At the end of level 15, I made 323 in earnings and served 17 customers. Before starting level 16, I upgraded my lettuce leaves (product) and my cola dispenser to make two colas at once. At the end of level 16, I earned 343 coins and served 20 people. Before level 17, I upgraded my tomatoes. At the end of level 17, I earned 377 coins and served 16 people. I upgraded my hotdog buns (product) before starting level 18 and then the game introduced fries (product) at the beginning of the level. At the end of level 18, I made 369 in coins and served 19 customers. I stopped here for the day. My completed tasks for the day were burning one dish, upgrade my cola to level 1, and serve 2 colas in 7 seconds. Tomorrow I will try to purchase one upgrade that increases tips, serve 3 colas in 7 seconds, and upgrade every ingredient to level 1.

**Day #5:** On day 5, before I started level 19, I upgraded my deep fryer to fry my fries (product) quicker. At the end of level 19, I made 381 (coins) in earnings and served 18 people. Before I started level 20, I upgraded my deep fryer. Upgrading the deep fryer really helped during level 20 because it made two portions of fries at once. By the end of level 20, I had made 388 (coins) in earnings and had served 19 customers. Before starting level 21, I upgraded the tables in the restaurant (place) and maxed out my upgrades on my burger tabletop, making three plates available to serve them on now. The game introduced cupcakes at the beginning of the level, which give you bonuses (promotion). At the end of level 21, I made 416 in earnings and had served 21 customers. I updated my food warmer before starting level 22. At the end of level 22, I had earned 417 coins and served 21 customers. Before starting level 23, I upgraded my hotdog tabletop so I can serve 3 hotdogs at once now. At the end of level 23, I had earned 429 coins and served 18 customers. At the end of level 24, I had earned 451 coins and served 21 customers. I then updated my cola before starting level 25. At the end of level 25, I had earned 499 coins and served 23 customers. I stopped here for the day. I completed the tasks of upgrading every ingredient to level 1, upgrading every appliance to level 1, and purchased all the spaces on the tabletop. Tomorrow I hope to purchase one upgrade that increases tips, serve 3 colas in 7 seconds, and fill the whole tabletop with meals.

In order to examine student feedback of the marketing mix activity, comments from question 4 – *Overall, what did you learn about the application of the marketing mix from this activity* – in the Executive Summary were reviewed and themed as a qualitative, open-ended response. After reviewing student comments three themes relating to the marketing mix were prevalent: 1) application to business (business), 2) application to marketing (marketing), and 3) application using the game (game). There were 34 students in the class (n=34) and though each student answered the question, not all responses could be easily categorized into a theme due to the vagueness of the response or the indirect way in which the student answered; therefore, the response rate reported for each theme reflects only those answers that could be confidently categorized for analysis. The adjusted response rate for each theme ranged from 84.2% (business, marketing) to 88.2% (game). The results of this analysis are shown in Table 1.

**Table 1: Summary Data Question #4 – Student Feedback of Marketing Mix Activity**

<b>Theme (Business)</b>	<b># Responses</b>	<b>% Responses</b>
Marketing applies to all areas of business	11	32.4%
Important to long-term success	5	14.7%
Reinvest in the business	4	11.8%
More than selling	3	8.8%
Time Management	2	5.9%
Patience	1	2.9%
Past info for planning	1	2.9%
Scarcity of resources	1	2.9%
<b>Total</b>	<b>28</b>	<b>82.4%</b>
<b>Theme (Marketing)</b>		
customer satisfaction	11	32.4%
improves decision-making	5	14.7%
helps business grow	4	11.8%
supports product decisions	3	8.8%
complex part of business	3	8.8%
more than advertising	1	2.9%
marketing is fun	1	2.9%
<b>Total</b>	<b>28</b>	<b>82.4%</b>
<b>Theme (Game)</b>		
Improved understanding	15	44.1%
Fun way to learn	6	17.6%
Experience	4	11.8%
Different than most assignments	2	5.9%
Informative	1	2.9%
Interesting project	1	2.9%
Educational	1	2.9%
<b>Total</b>	<b>30</b>	<b>88.2%</b>

After analysis, the data in Table 1 was compared to the learning objectives established for the activity. Across all three themes, student comments showed congruence with the learning objectives. In the category of *game*, students responded overwhelmingly that using the game “improved understanding” (n=15). Similarly, in the category of *marketing*, students responded that the activity “improved decision-making” (n=5). These responses support the first learning objective: *demonstrate understanding of the marketing mix*.

In the categories of *business* and *marketing*, respectively, student responses indicated that the activity helped to understand how marketing 1) “applies to all areas of business” (n=11), 2) “is important to long-term success” (n=5), and 3) “helps the business grow” (n=4). These responses support the second learning objective: *apply the concepts of product, price, promotion, and place to the growth of the business*.

In the category of *marketing*, students responded that applying the marketing mix to their game play improved not only “customer satisfaction” (n=11), but also “improved decision-making” (n=5). These responses support the third learning objective: *connect the facets of the marketing mix to simulated, real-world consumer experiences*.

In the category of *game*, students responded overwhelmingly that using the game 1) “improved understanding” (n=15), 2) “was a fun way to learn” (n=6), and 3) “was a positive experience” (n=4) for learning. These responses support the fourth learning objective: *engage in fun, active learning that aids in understanding and recall of the topic*.

Overall, aggregate feedback from the marketing mix activity indicated that students enjoyed the learning experience and found it to be a welcome change from standard assignments. Many also stated that it was “fun” and an “interesting way to learn about marketing”, with one student commenting, “*I believe that playing this game really does correlate in a way to how it works in real life. It also goes to show how much the average person does not realize how you can relate the marketing mix to almost anything and everything. Also, using this game as a breakdown for the marketing mix helped me understand and grasp what exactly the four p’s are all about.*”

An example of a student submission of the Executive Summary is available in Appendix C.

## STUDENT PARTICIPATION RATE AND PERFORMANCE

To understand if a difference in participation and performance existed between types of assignments, the components of the marketing mix activity – Canvas journal (n=34) and Executive Summary (n=34) – were compared to fourteen quizzes that were assigned during the semester. Participation rates were based on the percentage of the 34 students who completed each assignment; student performance was calculated by averaging student grades for each assignment: Canvas Journal, Executive Summary, and Quizzes. Results of this analysis are presented in Table 2.

**Table 2: Participation Rate and Average Grade Comparison to Quizzes**

	Participation Rate	Average Grade
Canvas Journal (n=34)	100.0%	91.9%
Executive Summary (n=34)	100.0%	98.5%
14 Quizzes (n=34)	98.3%	88.9%

Participation in both components of the marketing mix activity was 100%. Comparatively, this rate was marginally higher than the average participation rate (98.3%) for the fourteen online quizzes given during the same semester. Similarly, average grades for the components of the marketing mix activity ranged from 3% to 10% higher than the quizzes (88.9%). Despite being a small sample, these results support academic research that active learning not only improves engagement, but also positively impacts learning.

## DISCUSSION AND FUTURE RESEARCH

Traditional methods of teaching, while effective, do not always resonate with students. Some topics – especially those that require iterative decision-making – benefit from a hands-on approach that offers an immersive experience and allows students to adapt decision-making, as needed, for success. For the marketing mix activity, students created their own business and saw first-hand how every decision contributed to their growth in the game. Faulty decisions led to poor customer satisfaction, diminished revenue, and the inability to reinvest in the business for future growth. Conversely, using critical thought to evaluate each decision and categorizing them into the buckets of the four Ps – product, price, promotion, place – enabled students to comprehend how interpretation, planning, and adjustment are instrumental to long-term success due to the dynamic nature of business, the economy, and consumers.

The marketing mix activity contributes to literature by demonstrating the benefits of using gaming technology to improve engagement and learning in an undergraduate Principles of Marketing class. The results showed alignment between the faculty-proposed learning objectives and the feedback received by students in the Executive Summary. Ultimately, students learned that marketing is not only important to all aspects of a business, but also led to positive customer satisfaction when implemented correctly. In addition, students felt that using the game was a fun way to learn and improved their understanding of using the four Ps in the operation of a business.

Future research will add to these findings by increasing respondent data for individuals and groups, by section or semester. Levels of engagement, learning, and participation in the marketing mix activity will continue to be measured for students enrolled in the class; however, new statistical methods can be explored once the assignment has a larger base of students.

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The author wishes to thank her family, friends, and colleagues for their continued support throughout her academic and professional journey.



## APPENDIX A:

Sally's Spa is an addictive and exciting time management game where you run your own spa and beauty salon and grow to add locations around the world, including New York, Paris, Rome, Fiji, and much more!

Retrieved from:

[https://play.google.com/store/apps/details?id=com.gamescafe.sallysspalite&hl=en\\_US&gl=US](https://play.google.com/store/apps/details?id=com.gamescafe.sallysspalite&hl=en_US&gl=US)



### About

4.5/5	4/5	4.5/5
App Store - A...	LDPlayer	Google Play

**Developer:** Games Cafe

**Platforms:** Android, Microsoft Windows, iOS, Windows Phone, Classic Mac OS, Binary Runtime Environment for Wireless

**Publishers:** GamesCafe.com, RealArcade, Games Cafe, GameHouse, RealNetworks

**Initial release date:** June 4, 2008

Cook delicious meals and desserts from all over the world in this FREE addictive time-management game with a choice of more than 27 unique locations!

Retrieved from:

[https://play.google.com/store/apps/details?id=com.nordcurrent.canteenhd&hl=en\\_US&gl=US&pli=1](https://play.google.com/store/apps/details?id=com.nordcurrent.canteenhd&hl=en_US&gl=US&pli=1)



### About

4.4/5	4.5/5	4/5
Google Play	App Store - A...	Facebook

Cooking Fever is a cooking simulation mobile game developed in 2014 by Nordcurrent, a Lithuanian game developing and publishing company. In the game, players manage various restaurants by making foods and drinks, serving customers, and earning money. Wikipedia

**Developer:** Nordcurrent

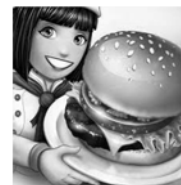
**Platforms:** Android, iOS, Microsoft Windows

**Publisher:** Nordcurrent

**Original author:** Nordcurrent

**Initial release date:** August 19, 2014

## APPENDIX B



### MKT 100 – Principles of Marketing

#### Application #1 – Applying the Marketing Mix

For this assignment, you will download one of the following games: Sally's Spa or Cooking Fever. Both apps are free (look for lite versions if you have to).

Both of these apps allow you to build the business from the ground up, so all of the decisions that you make will directly impact the outcome. **Your goal is to apply the marketing information that you learned this semester to more effectively and efficiently run your chosen business.** All of your information will be saved when you log out of the application.

1. Select the game you will chronicle for the week (Sally's Spa or Cooking Fever).
2. Begin testing the game and "learning the ropes". Identify the "problems" and goals that you will face throughout your business journey. Jot them in your Canvas journal.
3. Play the game every day for a minimum of 20 minutes. After each round, do the following:
  - Review your decision-making factors and make observations about the impact those decisions had on your daily operation - positive or needs improvement.
  - Be sure to track your customer count and sales (coins / money) level everyday to monitor growth and decline.
  - Identify "to do" items that you want to implement on the next day.
  - Track notes in your Canvas journal.
4. From your analysis in #2, categorize your "to-do's" based on the marketing mix (Product, Price, Promotion, Place) and briefly explain your logic about how these changes will help improve your sales and/or store operation.
5. At the end of your journey, briefly summarize the application in a one-page paper.
  1. Which facets of the marketing mix did you employ most frequently (rank them in descending order)?
  2. For the one used most frequently, explain why it had the most impact on your strategy.
  3. For the one used less frequent, explain why it didn't command a bigger role in your strategy.
  4. Overall, what did you learn about marketing from this experience?

#### **Grading:**

#### **Assignment Total: 100 pts**

Daily Journal - 35 pts

Marketing Mix Analysis - 25 pts

Critical Thinking (Thought provoking to-do items) - 20 pts

Executive Summary - 20 pts

## APPENDIX C

### Example: Student Submission of Executive Summary

Cooking Fever is a highly addictive game which can be downloaded onto your phone. The object of the game is to manage a restaurant, by serving customers and purchasing additional equipment and furniture, to improve efficiencies. I was tasked with playing this game for 6 days, in twenty minute intervals, but due to the highly addictive nature, I played all 120 minutes in two days. I began the game just learning the ropes and quickly made a plan to purchase as much product as possible, whenever possible, in order to have the most efficient, fast-paced restaurant in town.

One facet of the marketing mix that I employed most frequently was product. Whether it was serving customers product at the service counter, ordering product to speed up production, increase profit, or furnish my restaurant, product was everywhere! By purchasing equipment, such as tabletops, it allowed me to have multiple servings prepared ahead of time, before customers started arriving. This assisted in expediting service to my customers, which led to more revenue. Restaurant furniture was an important product to purchase, because customers are more likely to patronize a restaurant that is nicely furnished and well-organized.

If I had to rank the marketing mix categories in order, I would say product, price, place, promotion. Product, because it was the most used category, as described above. Price, because I constantly had to gauge price to determine profits when selling and purchasing products. Place, because furnishing my restaurant led to increased customer patience, which allowed me to be more efficient and ultimately led to more tips. Promotion I placed last, because I felt all other aspects needed to be in order before I began promoting my restaurant, in order to gain the most revenue.

Overall, I really enjoyed this assignment, because it was different and a welcome distraction from the monotony of regular exercises. This assignment paired well with the Marketing course, because it displayed the importance of the four P concepts we have been learning about throughout the semester. Succeeding at the game requires understanding your target audience's needs and wants, and serving your customers quickly and efficiently allows your revenue to increase rapidly. Without this knowledge, and a plan in place, you will quickly fall behind and lose customers, which will leave you with a failed restaurant.

# Remembering Why Small Effects Are Impressive: A Student Learning Driven Model for Curriculum Change

Jonathan R. Anderson, Southern Utah University, Utah, USA

## ABSTRACT

Managing the curriculum change process is challenging at best. This paper identifies a framework for faculty groups to approach curriculum change and the effects of changes on student learning outcome assessment performance. A traditional model for curriculum change is reviewed and compared to a Student Learning Driven Model for Curriculum Change. The effects of implementing this new model are outlined and discussed. This model provides a pathway to discover that in the curriculum change process, if curriculum change can improve student learning outcome assessment performance, even small effects are impressive.

**Keywords:** Curriculum Change, Curriculum Revision, Instructional Design

## INTRODUCTION

In 1992, Prentice and Miller published a brief but thoughtful article titled “when small effects are impressive.” In this article, the authors state that “Effect size is becoming an increasingly popular measure of the importance of an effect, both in individual studies and in meta-analyses. However, a large effect size is not the only way to demonstrate that an effect is important.” Their aim was to point out the distinction between a large effect and a meaningful effect. In this paper I intend to make the case that business curriculum innovations need a framework that also distinguishes between large effects and meaningful effects when modifying business curriculum. Using such a framework will encourage deep discussion on the outcomes of curriculum change and drive curriculum discussions away from the busyness of paperwork and process toward its ability to improve student outcomes.

In developing this model for curriculum change, it is important to note that we won’t have the space (or possibly the interest) to get into the details of which changes should be made. Nor will this paper get into the details of how to optimize the curriculum to meet today’s workforce needs (Giraud, Fawcett, and Fawcett, 2021). We will also leave largely absent from this discussion the balance between teaching theory and practice (McCarthy and McCarthy, 2006, McLaren, 2019). The scope of the model (and as a result, this paper) is to suggest that we can and should enhance the level of discussion surrounding what curriculum change processes have effects on student outcomes. We should also enhance efforts to make curriculum changes in business degree programs more meaningful and have larger impacts on student learning.

## A MODEL FOR FRAMING CURRICULUM CHANGE

For the purposes of this paper, we will define curriculum in its wider view to include: “teaching methods in addition to...content, goals, methods and assessment...but also extracurricular activities, learning environment and even hidden curriculum as well as cultures that would entail learning experiences” (Shao-Wen, 2012). Within this wider view, the curriculum encompasses all activities that lead to student learning, including the environment of instruction and the assessments associated with measuring student learning.

Within this definition, curriculum changes could come in a variety of forms including course additions or deletions, learning outcomes modifications, changes in pedagogy or andragogy, instructional design modifications, changes in learning modalities or instructional tools, or modifications to the instructional environment. With the scope of possible curriculum changes, it seems evident that a framework is needed to evaluate which curriculum changes may have the largest impact on student learning and how faculty within disciplines can help identify which changes could be most impactful. Without such a framework, faculty committees would spend significant amounts of time changing elements of curriculum without improving student outcomes.

A substantial body of research emphasizes the importance of curriculum change in terms of its process and intended outcomes (Howson & Kingsbury, 2021, Knight 2001). Within this literature, a special emphasis has been placed on

undergraduate business curriculum and its alignment with industry demands (Ward & Grand, 2019). Yet, little research has focused on the outcomes of curriculum change. This article aims to fill this gap by outlining the intended outcomes of curriculum changes and their effects on student learning. We focus here less on what should be taught, but on how we should approach the process of modifying current curriculum.

For the purposes of this conversation, it is assumed that the curriculum within a degree program is housed within a set of courses, each having its own set of learning outcomes associated with and leading to program level student learning outcomes. Further, it is assumed that the curriculum and methods of instruction lead to levels of student performance on assessments that have been developed to measure students' mastery of degree-level, course-level, and assignment level learning outcomes. If students fall short of the level of performance faculty would expect to see on the assigned assessments, curriculum changes are one possible approach to improving students' performance on assessments. In the aggregate, courses within an academic program should maintain the totality of learning that is anticipated for a student to master throughout the degree program. Each of the course-level learning outcomes should align with the program-level student outcomes and assignment-level student learning outcomes should align with and support course-level learning outcomes.

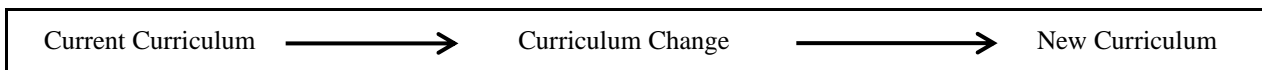
Unfortunately, these alignments don't always happen. Additionally, content taught in a program (based on learning outcomes on all levels) may become outdated as changes happen within disciplines and new knowledge is created and disseminated. Misalignment between learning outcomes on each level and changes in the knowledge base as new knowledge is created serve as the primary drivers of a need for curriculum changes. These and other changes in the knowledge basis often form the decision point for curriculum change, and the conversations begin.

Often, changes in curriculum begin by focusing on the structure of the degree program. Courses are added or removed, learning outcomes may be modified, new prerequisites and corequisites may be adjusted with the hope that each of these changes will strengthen students' performance on assessments that measure the level of student learning. However, little work has been done to explore why one of these pathways to curriculum change should be selected over another. Or, asked in the form of a research question, which curriculum change will have the largest impact on student learning? To explore this question, we need to define and differentiate between a curriculum change and its effect on student learning.

When discussing a curriculum change, it is simple to limit the discussion to structural changes within a degree program. One could limit the conversation to changes in courses, changes in learning outcomes, changes in course sequence, or changes in delivery modality. Using these limiting factors, faculty within a discipline could review the drivers of curriculum change and quickly identify which part of the degree program needs to be changed (new course, new sequence, etc...). Once the needed change is identified (and all of the political worries are settled, i.e., whose teaching schedule will be impacted the most) the changes are approved by the faculty and moved through the curriculum change process and the work is done. This process has at least two distinct flaws.

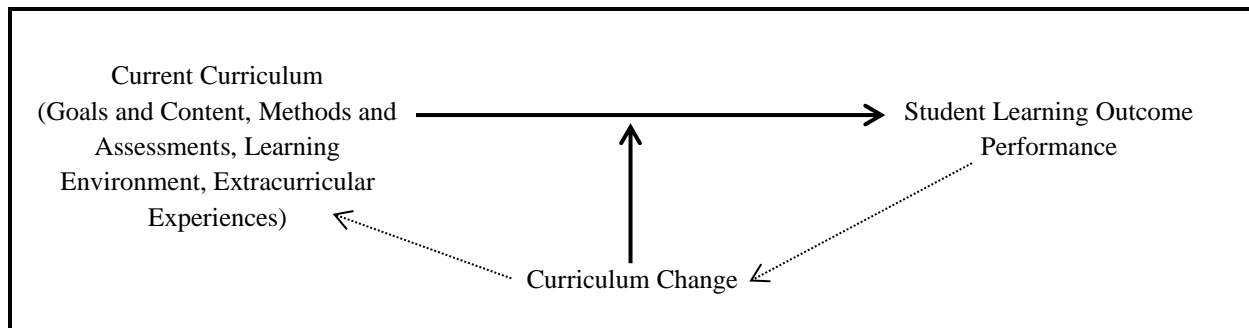
First, this limited model removes from the process the rich discussion based on the breadth and scope of the broader definition of curriculum noted earlier by focusing heavily on the current curriculum (within a limited definition of the term) and how modifications would change the current curriculum. Second, the outcome of this model is the new curriculum. While it is important to identify the new curriculum and all elements of its implementation, this model misses the inclusion of the primary purpose of curriculum change which is to influence the level of student learning within a degree program. This traditional model of curriculum change is outlined in Figure 1.

**Figure 1: Traditional Model for Evaluating Curriculum Changes**



In opposition to the model outlined in Figure 1, the model being developed in this paper focuses on the broader definition of curriculum, modifies the outcome of the curriculum change to be a change in student learning outcome assessment performance and introduces curriculum change as a moderator to this relationship. Feedback loops are also included to ensure the process is a cycle. This updated model noted here as the Student Learning Derive Model for Curriculum Change is shown in Figure 2.

**Figure 2: Student Learning Driven Model for Curriculum Change**



Why is this idea novel? This model isolates the outcome variable of curriculum change as being student learning outcome performance rather than change in the structure of the degree program. This new Student Learning Driven Model for curriculum change shifts the dependent variable to a focus on students. This is a unique approach compared to identifying a change in the degree program structure or set of courses as the dependent variable, as is often the case. If changes in the curriculum are the dependent variable, countless hours can be spent by faculty on paperwork and process, with little or no impact on student learning assessment outcomes. Additionally, this model introduces the curriculum change as moderating the relationship between the curriculum and student learning outcomes assessment performance. This is also a novel and integral part of a complete model for curriculum change as outlined below.

This Student Learning Drive Model for Curriculum Change combines each element of the broader definition of curriculum into four buckets. Curriculum Goals and Content focus on the elements within the discipline that the instructor intends to communicate. These are often expressed in the form of student learning outcomes and curriculum outlines and goals relate to the intended level of student mastery of the content. The Curriculum Methods and Assessments include all instruction strategies, delivery modalities and assessment measures that are aligned with the Curriculum Goals and Content. The Curriculum Learning Environment includes learning tools, the physical or electronic classroom space, the social environment, and the level and types of interaction between the instructor and the students. And finally, The Extracurricular Experiences refer to the activities that take place outside the typical instructional space (physical or electronic space). These activities may be assigned to the student to complete or led by the instructor. Often these activities are aligned with and enhance the activities that happen inside the classroom.

Including each of these curriculum elements in the model for curriculum change is essential to ensure that conversations about curriculum change don't get stuck inside the boxes of courses within a degree program. In an ideal setting, this model would serve as the basis for broad conversations about what a student should learn and the experiences students should have prior to completing a business degree.

If this model is used, faculty within a department can identify the characteristics of each element of the curriculum and focus on how these elements influence student learning assessment outcomes. Once the work has been completed, conversations about the structure of the degree program will become much richer as they are focused on how students should perform on learning outcomes assessments and a large host of drivers of this performance rather than simply focusing on what is currently being taught within courses, which courses students should take in order to graduate, and in what order students should take the courses. This statement clearly oversimplifies the traditional model, but it also emphasizes the importance of the broader perspective and case for a new Student Learning Driven Model for Curriculum Change.

This model also introduces the idea of a curriculum change moderating the relationship between the current curriculum and student performance on learning outcome assessments. The introduction of a moderator variable into a curriculum change model shifts and expands the conversation about curriculum change. Baron and Kenny (1986) state that "In general terms, a moderator is a qualitative (e.g., sex, race, class) or quantitative (e.g., level of reward) variable that affects the direction and/or strength of the relation between an independent or predictor variable and a dependent or criterion variable." In the case of curriculum change, we would anticipate that a consistent curriculum (in the broad definition outlined above) would lead to consistent student attainment on learning outcome assessment measures (all else being equal). When a change in the curriculum is introduced, we would anticipate that the modifications in the curriculum would moderate the original relationship between the curriculum and student learning outcome attainment.

Using the curriculum change as a moderating variable rather than mediating variable (as shown in the traditional model for curriculum change) has a number of distinctions.

In the traditional model for curriculum change, the mediating variable accounts for a stopping point between two ends. If the stopping point is missed in the decision tree, the relationship between the independent variable and the dependent variable likely would not exist or would simply have a spurious relationship. Simply stated, if a curriculum change did not happen, the old curriculum would be the same as the new curriculum. One could not move from point A to point C without moving through point B. In the Student Learning Driven Model for Curriculum Change, there is a current relationship between points A and C that is changed slightly or significantly by the introduction of point B. This moderating relationship is an important clarification in the process of curriculum change. It is essential to realize that a change in curriculum rarely changes everything, even when new courses and programs are introduced. Using the broader definition of a curriculum change, all elements are not changed at once and it is important to identify the outcome of some changes in the curriculum on student learning independent of other changes that may take place within the curriculum. As a team of faculty approaches the curriculum change process, realizing the importance of incremental changes and incremental progress is an essential step in improving student learning. This is certainly a case when “small effects are impressive” (Prentice and Miller, 1992)

### WHY ARE SMALL EFFECTS IMPRESSIVE?

We will now move to a discussion on the outcomes or effects of using the Student Learning Drive Model for Curriculum Change. When a change in curriculum is viewed as moderating the relationship between curriculum and student learning outcomes performance, the effect of the change has to be measured over time. It is difficult to measure the effect of a curriculum change unless you first have a baseline measure of the current performance levels of students who are receiving the instruction. For the purposes of this paper, we will define the effect of a curriculum change as the change in student learning assessment outcomes that directly results from a change in curriculum. Indeed, the curriculum must first be in place and a change in curriculum must precede the effect of the curriculum change.

Those included in curriculum changes can easily be enthralled with the idea that once a curriculum change is made, the work is done. For those who have been on curriculum committees or led such efforts, it is evident that curriculum changes are often less about their impact on student learning and may be driven more by territorial thinking and protection of past curriculum practices. However, if curriculum change processes begin by asking which element of student learning this curriculum change intends to influence, this student-focused outcome will more likely drive greater outcomes for student learning.

Curriculum changes can have a number of different outcomes. Any developed model of curriculum change should outline the potential outcomes that might come to fruition and include in its framework. Table 1 outlines the logical next step once a change in curriculum has been identified and implemented.

**Table 1: A Model for Identifying the Effects of Curriculum Change**

Course/Learning Outcomes	New Course	Current Course
New Learning Outcomes	New Effects	Incremental Effects
Current Learning Outcomes	Distributed Effects	Small Effects

The upper left quadrant captures curriculum changes that include new courses added to a degree program with their associated learning outcomes. This type of curriculum change often happens when a significant amount of new knowledge is introduced to an existing field. Examples include the introduction of fields such as data science, equity, diversity, and inclusion, and alternate currency models for investing. New knowledge, including but not limited to, those examples often require new courses with new learning outcomes added into existing degrees. In curriculum changes of this type, it is nearly impossible to assess whether or not there has been change in student learning assessment outcomes as both the course and the learning outcomes are new. In these cases, the optimal outcome is that a baseline performance assessment is collected and documented. In this model, we defined that outcome as a New Effect.

The upper right quadrant identifies those times when new learning outcomes are introduced into current courses. These curriculum changes often happen when small bits of new information or modified knowledge need to be introduced into a degree program. These changes may not be significant enough to justify a new course but can substantially alter the current content within existing courses. Because these are new elements added to the current instructional environment, they are represented here as incremental effects. Some could be new, but likely there will be a mix of new effects and changed effects. When new learning outcomes are added to current courses, significant discussion of assessment results will ensue as it will be challenging to delineate between which effects are new and those that are modified older effects, as such, for this model we identify these effects of curriculum change as incremental.

The bottom left quadrant represents those effects that are a result of new courses that include current learning outcomes. These curriculum changes often happen when faculty groups begin to rethink their current curriculum. In recent decades we have seen combinations of current learning outcomes recaptured in new courses in the data sciences, business analytics, or even going back a few decades to the addition of business policy or business strategy courses. These changes are a result of knowledge that has been taking place in existing courses, but the old structure of courses does not provide a sufficient framework to organize the knowledge. As current or expanding content is recaptured in new courses the effects of student learning in this model are defined as distributed effects. Changes of this type make documenting and analyzing improvements in student learning outcome performance challenging as measures previously collected within a course are now distributed across a set of new courses. These changes also provide many challenges to gauging improvements in student learning outcomes as many assessment measures will likely need to be retooled or reconfigured to match the new structure of courses and course sequence. As such, many assessment tools may need to be benchmarked again.

The bottom right quadrant represents the most challenging and fruitful effects of curriculum change. Rather than having the comfort and satisfaction of identifying success as a change in structure or delivery as we would with new learning outcomes or new courses, these curriculum changes require faculty to look introspectively at current teaching practices, assignments, student engagement, the student learning environment, and all facets of the curriculum (Shao-Wen, 2012). This removes the ability for any outcome curricular change to be celebrated as an outcome, as the same courses and learning outcomes remain in place. It is the curriculum changes that happen within current courses and current learning outcomes that can isolate and measure improvements in student learning assessment performance. This is really challenging work and requires deep reflection and very intentional engagement in micro curriculum improvements. It is in these changes that small effects are truly impressive.

## DISCUSSION

This paper shares a new and refreshing perspective on the ever-present practice of curriculum change. As noted earlier, we have focused on the broadest definition of curriculum to include “teaching methods in addition to...content, goals, methods and assessment...but also extracurricular activities, learning environment and even hidden curriculum as well as cultures that would entail learning experiences (Shao-Wen, 2012). As groups of faculty approach curriculum changes, this model recommends that faculty move beyond measuring success as a new curriculum, to measuring success by an improvement in student learning outcome performance. This shift will significantly reframe conversations as the dependent variable is driven by a desire to improve student learning.

This new model also identifies the curriculum change as a moderating variable rather than a mediating or outcome variable in the process of curriculum change. This moderating model allows for different types of effects to be reviewed, discussed, and analyzed. This model allows for curriculum change to be celebrated when even the smallest improvements in student learning outcomes assessment performance have been identified. Additionally, this moderating variable approach to curriculum change separates and isolates the change from all of the other elements of curriculum delivery that are part of the process.

As new knowledge is developed that needs to be incorporated into the curriculum, and as new delivery modalities, new goals and new elements of the learning environment continue to gain momentum, faculty groups need a framework to approach this work of curriculum change. With a significant increase in the emphasis on student learning outcome assessment improvements, a clear process that isolates and identifies increases in student learning assessment performance can help in many areas of teaching and accreditation activities. The intent of this paper is to develop such a model and provide a framework that faculty groups can use as they approach the monumental task of keeping the business curriculum current, relevant, and ready to prepare students to add value wherever they work and live. In this



process, this paper supports the suggestion that any improvement in student learning adds value. In this work, it is true that even small effects are impressive.

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# Do Multiple Learner Interactions Improve Learning for Accounting Students Having Differing Academic Achievement and Demographics?

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## ABSTRACT

This study examines whether prior academic achievement and certain demographic characteristics affect the types of learner interaction chosen by online introductory accounting students and whether those choices improve learning. The two types of online learner interactions that we study are learner-content (proxied by the viewing of instructor-created videos) and learner-instructor (proxied by the correctness of real-time polling responses). We partition our sample into subsamples based on prior GPA, age, semester hours, major, first time in college, receipt of financial aid, citizenship, gender, and ethnicity. Our results show that younger, male, and Hispanic students tend to select learner interactions that result in suboptimal learning, whereas Asian students and those with higher GPAs or financial aid optimize their learning by selecting multiple interactions. Our findings emphasize the need for educators to include multiple learner interactions in their courses and for students to take advantage of multiple learning aids.

**Keywords:** accounting, online education, student demographics, student achievement

## INTRODUCTION

The COVID-19 pandemic accelerated higher education's digital transformation to online learning. While most observers at the time were impressed at the speed of the transformation, many now question the quality of online learning and wonder whether the one-size-fits-all approach adopted by many educators is appropriate for a diverse generation of students (e.g., Rizvi et al., 2022). Our research is motivated by these concerns. In this paper we examine whether prior academic achievement and differing demographics affect the types of learner interaction chosen by online introductory accounting students and whether the choices made by these students improve learning outcomes.

All learners are unique, and some are more adaptive than others to change (e.g., Seemiller and Thomas, 2018; Gonzalez et al., 2020). The adaptiveness of the learner often relates to (a) baseline tendencies generally measured in terms of prior academic performance, and/or (b) social, economic, and individual-level circumstances. Prior research has identified learner-content and learner-instructor interaction as important components of effective online learning (e.g., Moore, 1989; Arbaugh and Benbunan-Fich, 2007). Learner-content interaction refers to the process by which a learner initiates and interacts in a pedagogically meaningful way with the subject matter or course content but does so on her own. Learner-instructor interaction refers to the process by which the instructor actively guides and facilitates learning. We refer to the combination of learner-content and learner-instructor interactions as multiple learner interactions.

The relationship between the use of multiple learner interactions and academic improvement was investigated in Meade and Parthasarathy (2020). The results showed that students who increased both types of learner interaction after the COVID-19 shift to virtual instruction in Spring 2020 obtained final exam scores that were, on average, over 10 percent higher than students who decreased both types of learner interaction. Compared to students who increased only one type of learner interaction, those who increased both learner interactions attained scores that averaged almost 3 percent higher. This paper extends the earlier work of Meade and Parthasarathy (2020) to investigate whether the choice of learner interactions differs among students with differing prior academic achievement and demographic characteristics and whether the selected interactions improve learning.

## PREVIOUS RESEARCH

Effective instruction requires student engagement, and engagement is generally best developed through interaction (e.g., Anderson, 2003; Marks et al., 2005; Malan, 2020). Before the COVID-19 pandemic, most interaction took place in physical classrooms. The pandemic altered the delivery of higher education and, in so doing, impacted the types of interaction available to students (e.g., Sangster et al., 2020). Moore (1989) identified three types of interaction inherent in effective online courses: learner-content, learner-instructor, and learner-learner. In this paper, we focus on the first

two types of interaction. We leave it to future studies to test the efficacy of the third type of interaction (learner-learner) in the context of accounting education.

Learner-content interaction is the process traditionally identified as learning. It occurs when a learner interacts intellectually with the subject matter or course content, resulting in changes to the learner’s cognitive structures. Content may take the form of text, audio, video, visuals, or some combination, but it should allow learners to adapt the learning materials to their individual learning style.

Learner-instructor interaction refers to the level of involvement between the instructor and the learner. Although this type of interaction is typically associated with the lecture format, it encompasses all forms of instructor-driven interactions. In synchronous online learning environments, learner-instructor interactions may take the form of virtual lessons, virtual office hours, shared screens, polling, chat, and other tools of engagement. Table 1 provides examples of learning strategies and tools commonly used to promote learner-content and learner-instructor interactions.

**Table 1: Examples of Learner Interactions in Online Learning Environments**

<b>Interaction</b>	<b>Synchronous</b>	<b>Asynchronous</b>
Learner-content	N/A	Textbooks Adaptive smart books Videos Podcasts Visuals Journals
Learner-instructor	Virtual lessons Virtual office hours Shared screens Virtual whiteboards Polling Chat	Discussion forums Email Voice mail Curated blogs Wikis Announcements Checklists Posted feedback

While learner-content and learner-instructor interactions are present in both face-to-face and online courses, their importance is heightened in online environments due to challenges associated with physical and emotional distance (e.g., Hansen and Reich, 2015; Fogarty, 2020; Lowenthal et al., 2020). Recent studies show that the pandemic and the associated pivot to online education impacted students from different socio-economic backgrounds differently, and that much of the academic and economic impact fell disproportionately on lower-income, women, and minority students (e.g., Dorn et al., 2020; Klebs et al., 2021; National Center for Education Statistics, 2021). Motivated by these studies, this paper seeks to answer the following two research questions.

Research Question 1: Does prior academic achievement and demographic characteristics affect the types of learner interaction selected by students?

Research Question 2: Is improvement in learning from multiple learner interactions descriptive of students having different academic and demographic backgrounds?

## **RESEARCH DESIGN**

Data come from 10 sections of an introductory managerial accounting course that, due to the COVID-19 pandemic, moved from face-to-face instruction to synchronous virtual delivery on Zoom in mid-March 2020. The course was coordinated by a lead instructor and all instructors taught the same content and shared common syllabi, textbooks,

assignments, and exams. Prior to the shift to virtual delivery, students had attended in-person instruction held on the campus of a large, public, doctoral degree-granting university located in the United States and having enrollment of approximately 47,000 students. In 2020, the spring semester commenced in mid-January and concluded in mid-May. The primary topics covered in the course were types of costs, job and process costing, marginal costing, cost-volume-profit analysis, capital budgeting, master budgets, product costing and pricing, business decision evaluations, and performance evaluation.

Required material for the course included a textbook, which came with access to the publisher's website and online learning aids. Students also had access on the course Learning Management System (LMS) to instructor-created videos covering both conceptual knowledge and problem-solving applications. The videos ran between 15 and 20 minutes in length and included narration and handwriting in a style that replicated an instructor giving a lecture while writing on a whiteboard. The videos served as a supplementary learning aid such that students could watch them asynchronously at their own pace either before or after a topic was discussed in the live class. The videos were created by the lead instructor and were available to students enrolled in all 10 sections. Within the LMS, the statistics tracking feature was enabled which allowed the viewing patterns of students to be tracked and analyzed. Course grades were based on student scores on exams, in-class polling questions, and out-of-class assignments.

Before the shift to synchronous virtual delivery, students had completed a midterm exam, several assigned homework problems, and some in-class polling questions. They had also been encouraged to watch the instructor-created videos that corresponded with the covered content. After the COVID-19 pandemic and the move to virtual instruction, students completed the remaining homework assignments, in-class polling questions, and cumulative final exam. In addition, they were again reminded to watch the remaining instructor-created videos. Both before and after the transition to virtual instruction, students were incentivized to attend the face-to-face and virtual classes by including polling scores in the calculation of the final grade. Scores on the in-class polling questions accounted for approximately 7 percent of the course grade. Although the course grade did not explicitly include an incentive for viewing the instructor-created videos, students were awarded with extra credit points worth up to 1.4 percent of the final grade.

Like Meade and Parthasarathy (2020), the design of this research is unique in that the synchronous component of the course incorporated polling in both the face-to-face setting and the virtual classroom. Likewise, the course included short, out-of-class instructor-created videos embedded in the LMS both before and after the transition to online instruction. Absent the pandemic, we would expect that the choice of learner interactions would follow a predictable trajectory, with higher-achieving students maintaining or increasing the two types of learner interaction and lower-achieving students decreasing these interactions. But the pandemic, with its arbitrary disruptions to work schedules, childcare services, schooling, internet connectivity, and study spaces changed this trajectory by forcing students with differing academic and demographic backgrounds to reassess and modify their choice of learner interactions in light of their changed personal circumstances (e.g., Sangster et al., 2020). Our design exploits this setting by using each student as her own control and, in so doing, provides us with a more powerful lens through which to examine the impact of learner interaction choice on exam performance than much of the previous research.

### **Methodology**

The managerial accounting course which we study had 1,019 students enrolled, of which 41 withdrew before receiving a final grade and 24 were new to the university and missing a measure of incoming GPA which we use in our analysis as a measure of prior academic achievement. The final sample, therefore, consists of 954 students. Of these 954 students, the lead instructor taught three sections with a total of 378 students, a second instructor taught five sections with a total of 441 students, and a third instructor taught two sections with a total of 135 students. Untabulated statistical analyses indicate that the instructor did not significantly affect exam performance or the choice of learner interactions.

As in Meade and Parthasarathy (2020), this study uses a 2x2 design to classify each student into one of four learning modes based on her pre- and post-COVID-19 choice of learner interactions. We treat viewing of the instructor-created videos as a proxy for learner-content interaction and measure it as the percentage of available videos watched in the pre- and post-transition periods. We treat the correctness of in-class polling questions as a proxy for learner-instructor interaction and measure it using the ratio of correct polling responses to total possible polling responses in the pre- and post-transition periods.

In support of our choice of proxy measures is a survey by Martin and Bolliger (2018) of 155 online students attending eight universities across the United States. Their study examined student perceptions of various engagement strategies used in online courses, categorized according to the type of learner interaction. Their results showed that students viewed learner-instructor interaction as the most important, followed closely by learner-content interaction.

In our 2x2 design, our four learning modes correspond to changes in a student's learner interactions between the pre- and post-transition periods. Our first learning mode, which we label as "Video Down/Polling Down," is composed of students whose video viewing and polling correctness decreased in the post-transition period. Our second learning mode, which we label as "Video Up/Polling Down," is composed of students whose video viewing increased in the post-transition period, but whose polling correctness decreased. Our third learning mode, which we label as "Video Down/Polling Up," is composed of students whose video viewing decreased in the post-transition period, but whose polling correctness increased. Our fourth learning mode, which we label as "Video Up/Polling Up," is composed of students who increased both their video viewing and polling correctness in the post-transition period. We use a single categorical variable to identify changes in learner interactions rather than two continuous variables because we do not expect a monotonic relation between changes in video viewing/polling correctness and exam performance.

### **Model and Variables**

To test the impact of multiple learner interactions, Meade and Parthasarathy (2020) employed an ANOVA with *ExamDiff* as the response variable and *Learning\_Mode* as the predictor variable. We use a model similar to theirs and measure *ExamDiff* as the difference between a student's score on the cumulative final exam, which occurred after the COVID-19 transition to virtual instruction, and the midterm exam, which occurred before the transition. *Learning\_Mode* is measured with four levels, which in this paper we label as Video Down/Polling Down, Video Up/Polling Down, Video Down/Polling Up, and Video Up/Polling Up.

To address our two research questions, we partition our sample into several subsamples. We measure prior academic achievement using a student's incoming GPA and classify students into three subsamples representing grades of A, B or C, and D or F. We also categorize students on the basis of age, semester hours, major, first time in college, receiving financial aid, gender, citizenship, ethnicity, and grading option. We test for significant differences in the choice of learner interactions among our continuous variables using an ANOVA; among our categorical variables we use a chi-square test. We include the satisfactory/no credit (S/NCR) grading option in our study because our university, like many others, implemented an interim grade policy shortly after transitioning to online learning. The policy allowed students to elect grades of satisfactory or no credit on a course-by-course basis at the end of the semester after viewing their assigned letter grades. To test for significant differences in the effect of different types of learner interaction across our subsamples, we use pairwise t-tests. These tests use the least square means rather than arithmetic means and adjust for the unbalanced nature of the subsamples.

### **Descriptive Statistics**

Descriptive statistics for our subsamples are presented in table 2, together with the results of our ANOVA and chi-square tests. Although the mean and median scores on the cumulative final exam are generally lower than those on the midterm exam (each exam is worth 100 points), the declines are within the historical range of students enrolled in prior semesters. Not surprisingly, the mean final exam score is lowest for students who decreased both their video viewing and polling correctness (Video Down/Polling Down). Yet, the median change in exam score for these students is the same 2-point decline observed for students in the modes Video Down/Polling Up and Video Up/Polling Up. Students in the learning mode Video Up/Polling Down display a 5-point decline in the median score. ANOVA tests of the means identify statistically significant differences among the exam scores of the four learning modes and indicate that students with higher GPAs increased their reliance on videos as their mode of instruction at the expense of synchronous instruction. An ANOVA test of the means of students' age is also statistically significant, suggesting that different learner interactions appeal to students of differing GPA and age. The means of students' semester hour loads, however, are not significantly different across the four learning modes.

Chi-square tests address whether the proportion of students who selected a particular learner interaction is similar to the expected proportion. Statistically significant differences are observed for all the demographic characteristics except for the indicator variable measuring whether a student is receiving financial aid. Among the more observable differences are the overrepresentation of younger and male students in the Video Down/Polling Down learning mode and the overrepresentation of younger students and those attending college for the first time in the Video Up/Polling Down learning mode. Among the ethnicity categories, Whites are overrepresented in the Video Down/Polling Up learning mode, Asians are overrepresented in the Video Up/Polling Up learning mode, and Hispanic/Latinx are

overrepresented in the Video Down/Polling Down learning mode. Among students electing the S/NCR grade option, the observed clustering in the lower grade categories is not surprising, nor is the concentration in the Video Down/Polling Down learning mode.

**Table 2: Descriptive Statistics**

Learner Interaction	Learning Mode				F value	Pr>F
	Video Down/ Polling Down	Video Up/ Polling Down	Video Down/ Polling Up	Video Up/ Polling Up		
Video viewing	Decrease	Increase	Decrease	Increase		
Polling accuracy	Decrease	Decrease	Increase	Increase		
<b>Performance (mean / median)</b>					<b>F value</b>	<b>Pr&gt;F</b>
Midterm exam score	69.92 / 70.00	74.33 / 77.00	69.31 / 70.00	70.08 / 74.00	6.59	0.0002
Final exam score	63.26 / 68.00	71.22 / 72.00	65.70 / 68.00	70.69 / 72.00	15.52	<.0001
Change in exam score	-6.66 / -2.00	-3.11 / -5.00	-3.61 / -2.00	0.61 / -2.00	6.15	0.0004
<b>Demographics (mean / median)</b>						
Incoming GPA	3.14 / 3.19	3.37 / 3.50	3.11 / 3.18	3.27 / 3.40	10.21	<.0001
Age	20.40 / 20.00	20.43 / 20.00	21.40 / 20.50	21.38 / 20.00	8.15	<.0001
Semester hours load	13.74 / 15.00	14.06 / 15.00	13.59 / 15.00	13.72 / 15.00	1.45	0.2261
<b>Distributions (percent / proportion)</b>					<b>Chi-square</b>	<b>P-value</b>
Age (20 or less)	71.57 / 34.63	70.18 / 32.36	52.83 / 12.14	56.83 / 20.87	25.51	<.0001
Semester hours (15 or more)	60.87 / 31.22	65.96 / 32.25	55.24 / 13.55	59.03 / 22.98	5.32	0.1500
Business major	54.85 / 33.33	52.98 / 30.69	41.96 / 12.20	51.54 / 23.78	6.81	0.0784
First time in college	72.24 / 31.53	78.25 / 32.55	64.34 / 13.43	67.84 / 22.48	11.57	0.0090
Receiving financial aid	90.30 / 30.72	92.98 / 30.15	90.21 / 14.68	94.71 / 24.46	4.49	0.2135
U.S. citizen	93.31 / 32.56	87.37 / 29.05	91.61 / 15.29	87.22 / 23.10	8.01	0.0452
Gender, male	66.56 / 35.86	60.00 / 30.81	62.24 / 16.04	42.29 / 17.30	33.53	<.0001
Ethnicity					20.08	0.0657
White	17.73 / 29.28	18.25 / 28.73	25.87 / 20.44	17.18 / 21.55		
Asian	21.74 / 24.79	31.93 / 33.96	26.57 / 14.83	32.60 / 27.61		
Black	9.36 / 29.79	10.18 / 30.85	9.79 / 14.89	10.13 / 24.47		
Hispanic/Latinx	40.47 / 36.89	30.53 / 26.52	30.77 / 13.41	33.48 / 23.17		
Other	10.70 / 38.55	9.12 / 31.33	6.99 / 12.05	6.61 / 18.07		
Satisfactory/No credit	51.84 / 40.68	30.18 / 22.57	42.66 / 16.01	34.80 / 20.73	31.95	0.0002
A	0.00 / 0.00	0.00 / 0.00	0.00 / 0.00	0.00 / 0.00		
B	27.74 / 31.85	48.84 / 31.11	21.31 / 9.63	46.84 / 27.41		
C	49.03 / 42.46	40.70 / 19.55	50.82 / 17.32	46.84 / 20.67		
D	17.42 / 50.00	10.46 / 16.67	21.31 / 24.07	6.32 / 9.26		
F	5.81 / 69.23	0.00 / 0.00	6.56 / 30.77	0.00 / 0.00		
<b>Sample sizes</b>	299	285	143	227		
<b>Expected proportion</b>	31.34	29.87	14.99	23.79		

## Key Results from Table 2

- Suboptimal learner interactions tend to be selected more often by students with lower GPAs or those who are younger, male, or Hispanic/Latinx.
- Learner-content interactions in the form of recorded videos generally are preferred by younger students and those attending college for the first time.
- White students tend to prefer instructor interactions over content interactions, while Asian students generally seek out both instructor and content interactions.

## Pairwise Comparisons

Table 3 reports pairwise comparisons of the effect of learner interactions on the change in exam scores for subsamples of different academic and demographic backgrounds. In an earlier study, Meade and Parthasarathy (2020) showed the students who increased both their video viewing and polling correctness scored significantly better on the final exam than students who had not increased both types of learner interaction. Our pairwise tests seek to determine whether the improvement observed by Meade and Parthasarathy (2020) is descriptive of most students irrespective of their prior academic achievement or demographic characteristics.

Across all the reported subsamples except students electing a letter grade rather than the S/NCR grading option, the greatest improvement in exam scores (as measured by the least square means) occurred for students increasing their use of multiple learner interactions. This finding bolsters the results of Meade and Parthasarathy (2020) and highlights the importance of including multiple learner interactions in online courses. Looking at the pairwise t-tests, the exam score improvement associated with the use of multiple learner interactions (Video Up/Polling Up) is significantly better than the improvement associated with the use of one or no learner interactions for students having an incoming GPA in the A range, those attending college for the first time, those receiving financial aid, and those holding U.S. citizenship.

Subsamples showing that an increase in the use of multiple learner interactions improves exam scores as well or better than a single learner interaction for students aged 20 years or less, those enrolled in 15 semester credit hours or more, those enrolled in less than 15 semester credit hours, those with a major other than business, those of Hispanic/Latinx descent, and those electing either a letter grade or the S/NCR grade option. Subsamples for which increasing the use of multiple learner interactions provides a boost to exam scores only when compared to decreasing the use of learner interactions are students with an incoming GPA in the B or C range, those aged over 20, those majoring in business, and those of White or Asian descent. Both males and females benefited from the use of multiple learner interactions, although as mentioned earlier, males tended to reduce their learner interactions more than females. Subsamples showing no significant difference in exam scores regardless of the types of learner interaction utilized are Black students and those with an incoming GPA in the D or F range. We urge caution in interpreting this latter result, however, because of the small number of students classified as Black or with GPAs in the D or F range. Our insignificant results may simply reflect tests with low statistical power.

**Table 3: Pairwise Comparisons of the Effect of Learner Interactions on Exam Scores**

Learning Mode	Pairwise Comparisons (Pr >  t )					Pairwise Comparisons (Pr >  t )				
	GPA=A		Response variable = Exam_Diff			GPA=B or C		Response variable = Exam_Diff		
	n	Exam_Diff Means	Video Up/ Polling Down	Video Down/ Polling Up	Video Up/ Polling Up	n	Exam_Diff Means	Video Up/ Polling Down	Video Down/ Polling Up	Video Up/ Polling Up
Video Down/Polling Down	190	-4.94	0.2714	0.7821	0.0044	99	-8.43	0.2086	0.1190	0.0090
Video Up/ Polling Down	221	-3.05		0.5592	0.0584	60	-3.85		0.7166	0.2069
Video Down/ Polling Up	89	-4.33			0.0417	47	-2.28			0.4058
Video Up/ Polling Up	165	0.33				55	1.40			

Learning Mode	GPA=D or F					Age 20 or less				
	n	Exam_Diff Means	Video Up/ Polling Down	Video Down/ Polling Up	Video Up/ Polling Up	n	Exam_Diff Means	Video Up/ Polling Down	Video Down/ Polling Up	Video Up/ Polling Up
	Video Down/Polling Down	10	-21.50	0.1574	0.2518	0.1535	214	-6.17	0.3201	0.2147
Video Up/ Polling Down	4	5.25		0.6537	0.8286	200	-4.31		0.6116	0.0108
Video Down/ Polling Up	7	-3.57			0.7849	75	-3.04			0.1301
Video Up/ Polling Up	7	1.00				129	1.02			

**Table 3: Pairwise Comparisons of the Effect of Learner Interactions on Exam Scores (continued)**

<b>Age over 20</b>						<b>Hours 15 or more</b>					
<b>Learning Mode</b>	<b>n</b>	<b>Exam_Diff Means</b>	<b>Video Up/ Polling Down</b>	<b>Video Down/ Polling Up</b>	<b>Video Up/ Polling Up</b>	<b>n</b>	<b>Exam_Diff Means</b>	<b>Video Up/ Polling Down</b>	<b>Video Down/ Polling Up</b>	<b>Video Up/ Polling Up</b>	
Video Down/ Polling Down	85	-8.00	0.0152	0.2653	0.0089	182	-5.08	0.03081	0.1182	0.0028	
Video Up/ Polling Down	85	-0.27		0.2372	0.9138	188	-3.21		0.4351	0.0376	
Video Down/ Polling Up	68	-4.25			0.1869	79	-1.37			0.3564	
Video Up/ Polling Up	98	0.06				134	0.94				

<b>Hours under 15</b>						<b>Business majors</b>					
<b>Learning Mode</b>	<b>n</b>	<b>Exam_Diff Means</b>	<b>Video Up/ Polling Down</b>	<b>Video Down/ Polling Up</b>	<b>Video Up/ Polling Up</b>	<b>n</b>	<b>Exam_Diff Means</b>	<b>Video Up/ Polling Down</b>	<b>Video Down/ Polling Up</b>	<b>Video Up/ Polling Up</b>	
Video Down/ Polling Down	117	-9.04	0.0368	0.4200	0.0022	164	-3.62	0.5797	0.5766	0.0796	
Video Up/ Polling Down	97	-2.90		0.3145	0.3336	151	-2.48		0.3365	0.2235	
Video Down/ Polling Up	64	-6.39			0.0631	60	-5.17			0.0621	
Video Up/ Polling Up	93	0.13				117	0.27				

<b>Other majors</b>						<b>First time in college</b>					
<b>Learning Mode</b>	<b>n</b>	<b>Exam_Diff Means</b>	<b>Video Up/ Polling Down</b>	<b>Video Down/ Polling Up</b>	<b>Video Up/ Polling Up</b>	<b>n</b>	<b>Exam_Diff Means</b>	<b>Video Up/ Polling Down</b>	<b>Video Down/ Polling Up</b>	<b>Video Up/ Polling Up</b>	
Video Down/ Polling Down	135	-10.33	0.0080	0.0053	<.0001	216	-6.64	0.0630	0.6971	<.0001	
Video Up/ Polling Down	134	-3.81		0.6382	0.0651	223	-3.22		0.2972	0.0090	
Video Down/ Polling Up	83	-2.49			0.2369	92	-5.71			0.0023	
Video Up/ Polling Up	110	0.96				154	2.06				

<b>Financial aid</b>						<b>U.S. citizen</b>					
<b>Learning Mode</b>	<b>n</b>	<b>Exam_Diff Means</b>	<b>Video Up/ Polling Down</b>	<b>Video Down/ Polling Up</b>	<b>Video Up/ Polling Up</b>	<b>n</b>	<b>Exam_Diff Means</b>	<b>Video Up/ Polling Down</b>	<b>Video Down/ Polling Up</b>	<b>Video Up/ Polling Up</b>	
Video Down/ Polling Down	270	-7.01	0.3160	0.0349	<.0001	279	-6.70	0.0361	0.0836	<.0001	
Video Up/ Polling Down	265	-3.52		0.7097	0.0147	249	-3.40		0.9969	0.0130	
Video Down/ Polling Up	129	-2.77			0.0983	131	-3.39			0.0359	
Video Up/ Polling Up	215	0.69				198	1.26				

<b>Male</b>						<b>Female</b>					
<b>Learning Mode</b>	<b>n</b>	<b>Exam_Diff Means</b>	<b>Video Up/ Polling Down</b>	<b>Video Down/ Polling Up</b>	<b>Video Up/ Polling Up</b>	<b>n</b>	<b>Exam_Diff Means</b>	<b>Video Up/ Polling Down</b>	<b>Video Down/ Polling Up</b>	<b>Video Up/ Polling Up</b>	
Video Down/ Polling Down	199	-7.93	0.0303	0.2217	0.0021	100	-4.10	0.5227	0.4155	0.0302	
Video Up/ Polling Down	171	-3.56		0.5903	0.2176	114	-2.42		0.7622	0.1168	
Video Down/ Polling Up	89	-4.92			0.1221	54	-1.46			0.3501	
Video Up/ Polling Up	96	-0.52				131	1.44				

<b>White</b>						<b>Asian</b>					
<b>Learning Mode</b>	<b>n</b>	<b>Exam_Diff Means</b>	<b>Video Up/ Polling Down</b>	<b>Video Down/ Polling Up</b>	<b>Video Up/ Polling Up</b>	<b>n</b>	<b>Exam_Diff Means</b>	<b>Video Up/ Polling Down</b>	<b>Video Down/ Polling Up</b>	<b>Video Up/ Polling Up</b>	
Video Down/ Polling Down	53	-12.44	0.0937	0.0232	0.0059	65	-5.68	0.2278	0.1984	0.0875	
Video Up/ Polling Down	52	-6.02		0.4530	0.2236	91	-1.96		0.7287	0.5431	
Video Down/ Polling Up	37	-2.86			0.6732	38	-0.68			0.8876	
Video Up/ Polling Up	39	-0.97				74	-0.15				

<b>Black</b>						<b>Hispanic/Latinx</b>					
<b>Learning Mode</b>	<b>n</b>	<b>Exam_Diff Means</b>	<b>Video Up/ Polling Down</b>	<b>Video Down/ Polling Up</b>	<b>Video Up/ Polling Up</b>	<b>n</b>	<b>Exam_Diff Means</b>	<b>Video Up/ Polling Down</b>	<b>Video Down/ Polling Up</b>	<b>Video Up/ Polling Up</b>	
Video Down/ Polling Down	28	-7.54	0.7437	0.4160	0.3227	121	-5.31	0.0962	0.5230	0.0015	
Video Up/ Polling Down	29	-9.24		0.2791	0.1924	87	-0.78		0.0615	0.1345	
Video Down/ Polling Up	14	-2.29			0.9710	44	-7.48			0.0023	
Video Up/ Polling Up	23	-2.04				76	3.76				

<b>Letter grade</b>						<b>S/NCR grade</b>					
<b>Learning Mode</b>	<b>n</b>	<b>Exam_Diff Means</b>	<b>Video Up/ Polling Down</b>	<b>Video Down/ Polling Up</b>	<b>Video Up/ Polling Up</b>	<b>n</b>	<b>Exam_Diff Means</b>	<b>Video Up/ Polling Down</b>	<b>Video Down/ Polling Up</b>	<b>Video Up/ Polling Up</b>	
Video Down/ Polling Down	144	-0.89	0.8879	0.0621	0.0736	155	-12.00	0.1471	0.8152	0.0030	
Video Up/ Polling Down	199	-1.14		0.0372	0.0385	86	-7.65		0.1690	0.1637	
Video Down/ Polling Up	82	3.21			0.7229	61	-12.79			0.0089	
Video Up/ Polling Up	148	2.43				79	-2.81				

P-values are based on two-tailed t-tests.



### Key Results from Table 3

- Most students, irrespective of prior academic achievement or demographic characteristics, show improvement in exam scores when using multiple learner interactions.
- Students showing the greatest improvement in exam scores when using multiple learner interactions tend to be those with higher GPAs, those attending college for the first time, those receiving financial aid, or those holding U.S. citizenship.

### DISCUSSION

Our results show that many introductory accounting students did not select learner interactions that optimized their learning. Instead, many preferred a single type of learner interaction and, as a consequence, these students may have failed to achieve their potential, potentially hindering the advancement of their academic careers. Surveys conducted in similar settings to ours corroborate our observations and show that the pandemic impacted student learning in vulnerable populations (e.g., Aucejo et al., 2020; Dorn et al., 2020). Possibly the interim grade policy, which provided a safety net in the form of satisfactory/no credit grading, functioned as a disincentive to learning and contributed to the choice of suboptimal learner interactions (e.g., Karl et al., 2021). Other possible explanations include elevated demands at work, disruptions in childcare services, home schooling requirements, broadband reliability, and technology limitations. But whatever the reasons, our study finds that the greatest improvement in learning occurred among students who selected multiple types of learner interactions and that this improvement was achievable irrespective of academic or demographic backgrounds.

### CONCLUSION

This study provides empirical support of the improvement in learning that occurs when online introductory accounting students are provided with, and take advantage of, multiple learner interactions. We find that final exam scores are better for students using multiple learner interactions and that this result holds across almost all our academic and demographic subsamples. We also find that during the COVID-pandemic lower achieving, younger, male, domestic, and Hispanic/Latinx students tended to reduce their use of learner interactions and that this contributed to suboptimal learning.

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The study described in this manuscript was approved by the Institutional Review Board for the Use of Human Subjects in Research at the University of Houston.

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# Value of Certified Fraud Examiner Certification – Perceptions of Government Financial Managers

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## ABSTRACT

Financial managers of any organization have a responsibility to design, operate and assess a system of internal controls that includes safeguards against fraud. Professionals can aid in the fight against fraud by providing competencies in the areas of internal control design, governance, and fraud risk assessment. Services provided by those with expertise in fraud assessment will aid in the prevention and detection of fraud. The demand for such services has given rise to organizations which promote fraud prevention services. The Certified Fraud Examiner (CFE) credential offered by the Association of Certified Fraud Examiners provides testing, certification, and continued education for Certified Fraud Examiners. This research examines perceptions of government financial managers (GFMs) and public accountants working in government audit fields related to perceptions of the quality of service and career enhancements benefits associated with CFE certification.

Based upon our analysis of survey responses, we conclude that CFE certification provides benefits to both the certificate holder and to those who seek the services provided by CFEs. Additionally, respondents agree that many of the benefits will increase in the coming years. Our research may assist students who seek careers in fraud prevention in the development of career goals and strategies. Our research conclusions may also assist government financial managers in evaluating the need for and benefits provided by CFEs. Researchers may wish to extend this research to study the impact of similar specializations and credentials offered by other accounting-related organizations.

**Keywords:** Government Financial Management, Fraud, Certification, Accounting

## INTRODUCTION

Financial managers are responsible for the design, operation, and assessment of a system of internal controls that include the policies and procedures designed to ensure the (1) reliability of financial reporting, (2) the effectiveness and efficiency of operations (including safeguarding of assets), and (3) compliance with laws and regulations. In order to meet these objectives, the internal control system must be designed to prevent and detect fraud. Management must complete a thorough assessment of fraud risks and initiate the appropriate corporate governance which will minimize these risks. To meet these responsibilities managers must employ individuals who are competent and may be qualified not only in accounting but also in fraud risk assessment and detection.

Among certifications available to accountants, the Certified Public Accountant (CPA) is the most widely recognized, is said to “open the door” to a license to practice, and essential to many accounting career opportunities. “CPA” after one’s name generates respect and suggests knowledge and competence. Other (more optional) accounting-related certifications have become common in response to the demand for specialization in an increasingly complex business accounting world. Examples of these may include the Certified Internal Auditor (CIA), the Certified Management Accountant (CMA), and the Certified Information Systems Auditor (CISA). And also governmental accounting certifications like the Certified Government Financial Manager (CGFM) and Certified Public Finance Officer (CPFO).

The CFE is the first certification to specialize in fraud and has played a significant role in the fight against fraud since 1988. The CFE is recognized by the AICPA’s Statement of Auditing Standard Number 99 as beneficial and a certification that offers to assist with fraud assessment, detection, and governance as part of the development and continued assessment of the internal control system. Many pursue certification as a Certified Fraud Examiner (CFE) in response to the demand for fraud expertise and the increasing responsibilities of accountants and auditors to prevent and detect fraud. This research surveys GFMs to gather evidence of perceptions of the value and benefits of CFE certification.

## **Regulation - Response to Fraud**

Accounting scandals continue to plague corporate and accounting firms with schemes designed and perpetrated to either misappropriate assets or report fraudulent financial statements. To increase public confidence in the integrity of financial reporting, auditing standard setters issued two major pronouncements which clarify the auditor's responsibility to detect fraud.

Statement of Auditing Standards (SAS) Number 82, Consideration of Fraud in a Financial Statement Audit, issued in 1997, defined fraud in auditing standards for the first time. The statement provided greater direction regarding the auditor's responsibility for the detection and reporting fraud than previously existed. SAS 82 required auditors to plan and perform an audit to obtain reasonable assurance that financial statements were free of material misstatement whether caused by either error (unintentional acts) or fraud (intentional acts). The standard differentiated an assessment of the risk of material misstatement into two broad categories: (1) fraudulent financial reporting and (2) asset misappropriation. SAS 82 listed numerous fraud risk factors that auditors should consider relating to management, industry, and operational characteristics of the firm. When these fraud risks factors were identified, auditors were required to evaluate any potential risks based upon significance, likelihood for misstatement, and pervasiveness.

Statements of Auditing Standards (SAS) Number 99, Consideration of Fraud in a Financial Statement Audit, issued in 2002, superseded and adopted the auditor requirement of SAS No. 82 but provided additional guidance regarding responsibilities related to the risk of fraud in financial statements. SAS 99 (now codified as AU Section 316 - AICPA) significantly expands the discussion of the auditors' responsibility for fraud assessment in the conduct of an audit. Auditors are now required to (1) brainstorm, discuss and document potential fraud risks during the planning stages of the audit, (2) seek to identify potential fraud risks by making inquiries of management and others, and (3) consider fraud risk factors and other information that may be helpful in identifying risks of material misstatements due to fraud. Auditors must assess identified fraud risks and plan and conduct the audit based upon judgments about identified risks (AICPA, 2002). SAS No. 99 presents examples of fraud risk factors covering a broad range of situations which may be relevant in the process of identifying potential fraud and planning of the audit. The risk factors discussed in SAS 99 are classified and based on the three conditions generally present when fraudulent activities occur: (1) incentives/pressures, (2) opportunities, and (3) attitudes/rationalizations.

Corporate scandals (such as Enron, WorldCom, Tyco, Adelphia) prompted congressional legislation which resulted in the enactment of the United States' Public Company Accounting Reform and Investor Protection Act of 2002, popularly known as the Sarbanes-Oxley Act (SOX). The SOX not only gave the Securities & Exchange Commission accounting and auditing standard-setting authority for public companies but also requires CFOs and other upper management to evaluate and report on the adequacy of internal controls. SOX requires management to address the possibility of fraud risks and evaluate controls which may prevent or detect fraud.

Striscek R. & Hermanson D. (2010) reported to the Committee of Sponsoring Organizations (COSO) of the Treadway Commission that cases of fraudulent financial reporting by public companies have increased significantly (a total of 347 reported cases) over the period of 1998 to 2007 compared to the prior ten-year period. The median dollar amount of the alleged fraud increased to approximately \$12 million per case. CEOs and CFOs were accused of some level of involvement in more than 80% of the cases. More than one fourth of the firms changed auditors immediately prior to or during the period of fraudulent reporting. However, the ACFE's 2022 *Report to the Nations* reported that frauds in a two year look at particular fraud cases showed that 86% were not fraudulent reporting but employee misappropriation of assets. The problem of theft or reporting fraudulent schemes appear in that report to be just as prevalent today despite the focus on fraud in the new regulations required by SOX's Public Accounting Standards Board and the Auditing Standards Board.

## **Value of the Certified Fraud Examiner**

Responses of governmental and private regulators have caused major changes in the responsibilities of executives and accountants for the prevention and detection of fraud. These new regulations have placed added pressure on organizations to find qualified individuals with fraud expertise. This demand is expected to add value to professionals who have knowledge and experience in the auditing and fraud detection. The knowledge needed to perform audits, provide fraud consulting services, and engage in fraud investigations requires additional education in fraud and forensic accounting.

Accountants and auditors with fraud expertise will be positioned to assist in complying with new standards and

regulations in this new regulatory environment. The Association of Certified Fraud Examiners (ACFE) was founded for the purpose of combining the disciplines of accounting and fraud investigation. The Association offered the first forensic examination certification, the Certification in Fraud Examination, to the certification market. The Association of Certified Fraud Examiner (ACFE) has grown rapidly since its establishment in 1988 and presently has over 90,000 members of which more than 60,000 are certified. (acfe.com, 2023).

Certification with the ACFE requires the passing of a comprehensive exam which tests knowledge in the areas titled Financial Transaction and Fraud Schemes, Law, Investigation, and Fraud Prevention and Deterrence. Topics are tested in the areas of criminal justice, theories of crime causation, prevention techniques, accounting and auditing theory, internal controls, criminal and civil law, rules of evidence, data analytics and expert witness matters. Candidates who pass the exam and meet other membership requirements are awarded a Certification in Fraud Examination. Once certified, a CFE must complete a minimum of twenty hours of continuing professional education annually.

The value of the CFE is explicitly recognized by the AICPA in appendix to AU Section 316, Management Antifraud Programs and Controls which states that:

“Certified Fraud Examiners may assist the audit committee and board of directors with aspects of the oversight process . . . can provide extensive knowledge and experience about fraud that may not be available within a corporation. . . . can provide more objective input into management's evaluation of the risk of fraud . . . and the development of appropriate antifraud controls . . . . can assist the audit committee and board of directors in evaluating the fraud risk assessment and fraud prevention measures implemented by management. . . . conduct examinations to resolve allegations or suspicions of fraud. . . .”

The ACFE purports to add value to certificate holders by attesting that such individuals have knowledge of fraud assessment, detection, and prevention methods. The AICPA claims CFEs could add value. This research solicits the responses of government financial managers and other public accountants working in government financial audit roles (herein after referred to for simply as GGMs) to provide empirical evidence of the value of CFE certification.

### **Goals of the Study**

Most organizational executives assume that a CPA is a highly qualified accountant and has knowledge and expertise sufficient to justify reliance on such an individual in matters related to financial, tax and auditing issues. These perceptions provide distinct advantages for CPAs. Previous research on accounting and audit-related certifications suggests that business executives see value in certifications in addition to the CPA certification (Pabst & Talbot, 1991; Grambling & Myers, 1997). This survey research, as with similar research on the CFE, suggests that the designation is viewed favorably and empirical evidence is continuing to become available to assess the benefits of CFE certification related to career advantages, presumptions of competence, and benefits expected by those who use of the services offered by a CFE.

In this research we seek to determine perceptions held by GGMs of the value of the CFE. This study contributes to accounting-related certification research by providing empirical evidence of the perceived value of CFE certification based upon results of a survey of Government Financial Managers. Certification adds value if the designation provides career advantages related to recruiting, advancement and mobility. Certification adds value if it sends a signal to employers and clients of competence, a quality work product, and reliable recommendations. Certification adds value to firms if managers perceive that CFEs provide competent, reliable services that are useful in the performance of internal audits, external audits and fraud consultation services. The overall goal of this study is to provide a more complete understanding of the perceptions of benefits of CFE certification to individuals who have or would attain CFE certification and employers/clients who may need the services provided by CFEs. Business schools may wish to know the importance of the CFE to better advise students and/or as a source of support for the impact contributed by their own faculty (Corkern, Morehead, & Morgan, 2017). We accomplish this goal by analyzing the responses of GGMs related to perceptions of the value of CFE certification.

### **LITERATURE REVIEW**

Accounting research literature has used surveys to document the value of the certified public accountant (CPA), certified management accountants (CMA), and certified internal auditor (CIA) certifications as well as the certified fraud examiner (CFE). Kreiser & Talbott (1981) and Pabst & Talbott (1991) examined the value of the CMA

certification by surveying chief financial officers and Grambling & Myers (1997) examined the value of the CIA certification with surveyed bank executives. Morgan & Nix (2011) began a stream of research on the CFE by surveying CPAs. Nix & Morgan (2013) continued the research by surveying chief financial officers. In Morgan, Booker & Chong (2014) the authors compared the results from the survey noted above contrasting the differences in perception of the CFE between the CPAs and CFOs.

CFOs of Fortune 500 companies were surveyed to obtain evidence of perceptions of the value of CMA certification. Pabst & Talbott (1991) compared the results of the survey to a similar survey conducted in 1980 by Kreiser & Talbott (1981). Pabst & Talbott noted a reduction in the percentage of respondents who agree that the CMA was currently (or in the future) of substantial importance in regard to internal advancement or external mobility. They concluded that most CFOs did not believe the CMA would ever become as important for management accountants as the CPA is for public accountants. They also noted that most university accounting departments place significant emphasis on the CPA and public accounting employment and tend to emphasize financial accounting, tax and auditing more so than managerial accounting. The authors concluded that the challenge faced by the Institute of Certified Management Accountants (ICMA) is that of lack of familiarity with the benefits of CMA certification. Pabst & Talbott conclude that the ICMA must market itself to business professionals and managers, accounting department faculty, and potential managerial accountants. They suggested that greater knowledge of the benefits of CMA certification will positively change perceptions of the certification.

Gramling and Myers (1997) measured perceptions of the benefits of the Certification in Internal Audit (CIA) designation. A survey was sent to a sample of Fortune 500 financial firms and large U.S. commercial banks. Respondents included CFOs, directors of internal audit, and members of the board of directors. Each of these individuals was assumed to have knowledge of the potential benefits of CIA certification. The authors concluded that the CIA certification is perceived to be valuable and (1) signals a significant level of audit competence, (2) important for advancement within internal audit departments, and (3) is considered favorable for job mobility within internal audit departments. The designation was not, however, perceived to be important for hiring or for career advancement decisions for non-internal audit positions.

Certified Public Accountants working in public accounting were surveyed by Morgan and Nix (2011) regarding benefits related to the CFE. The CPAs agreed that the CFE provides distinct career advantages related to recruitment, advancement and external mobility for internal audit positions and fraud prevention and detection positions, but did not agree that certification provided benefits related to external audit positions. CPAs also agreed the CFE sends a signal of quality service. These conclusions held true for both the current time period and five years in the future. CFOs respondents surveyed in Nix and Morgan (2013) indicated the CFE is, currently and in the future, expected to provide career advantages and have and will have presumptions of quality of services. The study provided evidence that CFE certification provides career advantages related to recruitment, advancement and external mobility. These advantages applied to positions in internal audit, external audit, and fraud prevention and detection. The authors concluded that CFOs have, both current and future, a favorable image of the CFE and that the CFE has an expected value in the workplace. Morgan, Booker and Chong (2014) compared these two user groups from these two previous publications. Their results indicated that CFOs hold the CFE in significantly higher regard than CPAs, both now and in the future. This may have shown that, in light of fraud training available to CPAs, that need of a CFE for a CFO may be greater than the need for a CFE for a public practice CPA. Morehead and Morgan (2022) surveyed government financial managers and contrasted six different accounting certifications and their value as a comparison and contrast to each other. This research directly stated that in the category of fraud prevention/detection and internal control, the perceived value of the CFE tied with the CPA currently and increased in value over the CPA five years in the future. The data from Morehead and Morgan (2022) specific to responses about the CFE are more deeply analyzed in the following sections of this paper

This survey study extends the research of Morgan and Nix (2011), Nix and Morgan (2013) and Morgan, Booker and Chong (2014) and Morehead and Morgan (2022) that focuses on perceptions regarding the value of the CFE. We use a similar albeit updated survey instrument to record and analyze perceptions of GFMs. The methodology and survey document incorporate many of the procedures and questions used in the above-mentioned research. This study also asked their current and expected perceptions (five years from now).

## METHODOLOGY

### Participants

A link to our survey was emailed to governmental accounting associations to solicit responses of GFM about the CFE. Executives from these associations initially took the survey and suggested changes to some of the wording for clarification. These changes were addressed and the authors then asked them to include a link to the survey in their perspective newsletters. A description and encouragement to participate were included for their readers. The responses were numerous and were used to obtain empirical evidence of the perceived value of CFE certification. The survey participants consist of those individuals who work in governmental financial positions at Federal, State, Local levels and others that may work in government service related industries in public accounting, academia, industry and others. The accountants working in non-government firms and in governmental consulting and auditing are additional individuals with direct experience to judge the benefits CFEs could provide to the GFM profession. The participant sample includes 230 government financial managers. Some of the respondents did not answer all of the demographic questions. Some of the demographic questions encouraged multiple responses. Survey demographics are listed in Table 1.

**Table 1: Government Financial Managers Demographics**

Government Financial Managers Demographics							
Employment		Discipline				Certification	
Answer Choices	Responses	Answer Choices	Responses	Answer Choices	Responses	Answer Choices	Responses
Federal Government	18.97% 37	Procurement	18.88% 37	CGFM	41.33% 81		
State Government	38.46% 75	Budgeting	39.29% 77	CPFO	2.04% 4		
Local Government	34.36% 67	Financial statement preparation	43.88% 86	CFE	11.22% 22		
Public Accounting	9.23% 18	Financial (accounting, A/P, A/R)	51.53% 101	CPA	61.22% 120		
Corporate Accounting	4.10% 8	Financial/Project Analyst supporting program	35.71% 70	CIA	14.29% 28		
Academia	7.69% 15	Management Advisory Services (Financial)	20.41% 40	CISA	3.06% 6		
Specialized Industry Areas	1.54% 3	Management Advisory Services (IT)	5.61% 11	None	10.20% 20		
Non-Profit	2.56% 5	Management Advisory Services (Healthcare)	2.55% 5	Other (please specify)	30.61% 60		
Other (please specify)	3.59% 7	Audit & Assurance Services	44.90% 88				
		Education	11.22% 22	<b>Level   Organization</b>			
<b>Years   Experience</b>		I do not/have not worked in the GFM profession	0.00% 0	Answer Choices		Responses	
Answer Choices	Responses	Other (please specify)	7.65% 15	Staff - Entry Level	3.57%	7	
Fewer than 5 years	2.04% 4			Staff - Supervisor Level	11.73%	23	
5 - 10 years	10.71% 21	<b>Level   Education</b>		Mid-Level Management	25.51%	50	
11 - 20 years	22.96% 45	Answer Choices		Senior Management	27.55%	54	
21 - 30 years	30.10% 59	High School or GED	1.03% 2	Executive Management	21.43%	42	
31 - 40 years	26.02% 51	Bachelor Degree	43.59% 85	Appointed or Elected	6.63%	13	
Over 40 years	8.16% 16	Master Degree	49.23% 96	Other (please specify)	8.67%	17	
		Professional Degree (J.D., etc.)	1.54% 3				
<b>Age</b>		Ph.D. or Other Terminal Degree	5.13% 10	<b>Generational   Group</b>			
Answer Choices	Responses			Answer Choices		Responses	
20-29	5.10% 10	<b>Gender</b>		Gen Z	0.51%	1	
30-39	15.31% 30	Answer Choices		Millennial / Gen Y	30.10%	59	
40-49	19.90% 39	Female	56.63% 111	Gen X	29.59%	58	
50-59	29.59% 58	Male	38.78% 76	Baby Boomer	34.69%	68	
60-70 and over	23.47% 46	Prefer Not to Answer	5.61% 11	Silent/Greatest	1.02%	2	
Prefer not to answer	6.63% 13			Prefer not to answer	6.12%	12	

\*Some respondents did not answer all of the demographic questions. Some questions may have solicited more than one response.

The demographic responses show a good cross-section of participants who work in federal, state and local governments as well as some academia and public accounting. They are diverse with disciplines in a wide variety of financial governmental accounting positions including procurement, budgeting, financial, audit and management advising services. Not one respondent answered no to the statement “I have not worked in government financial management”. Respondents (by 90%) report having obtained accounting certification and having accumulated many years of professional experience. Overall level of education is high, most participants represent many different levels of management in their organizations. Age and gender and membership in various generational groups suggest significant diversity.

### Survey Instrument and Research Questions

We measure GFM responses regarding perceptions of benefits of the CFE designation related to: (1) quality of services provided by CFE certification and (2) career enhancements provided by CFE certification. We ask questions designed

to see if GFMs currently recognize quality of service related to (1) financial statements, (2) financial systems, (3) audit, and (4) fraud prevention/detection/internal control. Further, we ask for perceptions of career enhancement related to (1) advancement, (2) mobility, (3) competency and (4) written/oral communication. More specifically we ask respondents whether the CFE designation signals enhanced value related to financial and audit positions in following services:

- (1) *financial statement preparation,*
- (2) *financial systems development,*
- (3) *auditing assurance, and*
- (4) *fraud prevention/detection and internal controls.*

We ask respondents if the CFE *was important for career placement related to*

- (5) *advancement to higher management positions within their organization, and*
- (6) *higher mobility/promotion outside their organizations.*

Additionally, we ask respondents whether the CFE *signals more competency with*

- (7) *a higher level of skill, knowledge and ability, and*
- (8) *a higher level of written or oral communication.*

Favorable perceptions regarding these quality and career components would add value to the CFE certification and enhance the professional reputation of individuals who obtain this designation. We ask respondents for their current CFE perceptions and expected CFE perceptions in five years.

Research provides evidence that certain recommendations made by a certificate holder have a greater likelihood of acceptance. These include recommendations related to assessment of audit, internal controls, development of corporate governance policies, and assessments of fraud-related risks and the preparation of reports. Certification research also asks about perception five years from now (Morehead and Morgan, 2022; Morgan, Booker and Chong, 2014; Nix and Morgan, 2013; Rose et al, 2012, Morgan and Nix, 2011; Olson, 2011; Barra, 2010; Ramaswamy, 2005; Pany & Whittington, 2001; Gramling and Myers, 1997). Our research questions focus on the above-noted topic areas and ask for current and future perceptions.

We analyze respondent's agreement/disagreement with each of the survey instrument statements using a 5-point Likert response scale. The response scale includes the following options: Strongly Disagree (-2), Disagree (-1), Neither Agree nor Disagree (0), Agree (+1), or Strongly Agree (+2). With this scale, the presentation of means, positive or negative, is easily interpreted. This methodology is easily understood, and responses about attitudes or beliefs from such a scale are likely to be reliable (Morehead and Morgan, 2022; Morgan, Booker and Chong, 2014; Nix and Morgan, 2013; Morgan and Nix, 2011; Grambling & Myers, 1997; Salant & Dillman, 1994).

The second set of research questions ask for the same information regarding the benefits of CFE certification. However, the respondents are asked to provide perceptions of these benefits in the future. Future is defined as "five years from now." These research questions are the same as those in the first set labeled currently, except using a "five years from now" time reference rather than the "currently" time reference. This is consistent with prior research (Morehead and Morgan, 2022; Morgan, Booker and Chong, 2014; Nix and Morgan, 2013; Morgan and Nix, 2011; Grambling & Myers, 1997; Salant & Dillman, 1994).

## **ANALYSIS OF RESULTS**

### **Percentages**

Table 2 presents percentage responses based upon participant agreement/disagreement with the question. For this analysis we added together those respondents who agreed (those who chose a 1, Agree) and those who strongly agreed (those who chose a 2, Strongly Agree) with the question. The authors did not expect that CFE certification would add value to the area of financial statement preparation. As expected, a majority of GFMs did not agree that a CFE gives value to financial statement preparation, however 41% agreement is not a trivial percentage. GFMs interestingly may have begun to believe that a better knowledge of fraud is helpful for financial reporting. This is indicative in the five-year future response total for statement preparation showing nearly 50% agreement. Systems development and



implementation, data analytics and cyber assurance are often seen as the purview of the IT department. The authors updated the prior research survey instrument to include this question that the CFE might be perceived as helpful with this area of expertise. The respondents solidly say yes, and they agree more so in the future.

**Table 2: Current and Future GFM Perception of the CFE – Percentage of Agree/Strongly Agree**

<b>Current and Future GFM Perception of the CFE – Percentage those who Agree/Strongly Agree</b>		
	<b>Current</b>	<b>Future</b>
<b>Quality   Career Enhancements</b>		
<u><i>Financial Expertise</i></u>		
<i>Statement Preparation</i>	41.6	49.7
<i>Systems Development &amp; Implementation   Data Analytics &amp; Cyber Assurance</i>	59.0	64.7
<u><i>Audit Expertise</i></u>		
<i>Assurance</i>	72.4	72.3
<i>Fraud Prevention &amp; Detection   Internal Controls</i>	88.9	90.0
<u><i>Career Mobility</i></u>		
<i>Within Their Organization</i>	39.0	50.8
<i>To Other Organizations</i>	53.3	65.4
<u><i>Greater Level of Competency with:</i></u>		
<i>Skills, Knowledge, &amp; Ability</i>	65.9	67.9
<i>Written &amp; Oral Communication</i>	45.1	51.7
Percentage of GFM Respondents who Agree or Strongly Agreed whether the CFE had value for each question. Collective Percentages are based upon scale of: -2 = Strongly Disagree, -1= Disagree, 0 = Neither Agree nor Disagree, 1= Agree, 2 = Strongly Agree.		

In positions related to audit assurance the GFMs show the CFE to be of importance and when you section positions specific to fraud prevention/detection and internal controls the CFE is shown to have much stronger agreement that the certification is useful. These positive responses for audit elements were expected and now confirmed. A majority of respondents did not currently agree that the CFE is good for upper mobility into top management positions within their own organizations, however, there is agreement the certification may help in the near future. Currently and more so five years from now GFMs think of the CFE as supportive for mobility in other organizations other than their own.

Both currently and more so in the future the GFMs seem to rate the CFE very high in adding a greater level of competency, skill, knowledge and ability. This question was meant to measure agreement that the CFE is generally useful to the holder. One of the potential areas of strength in any candidate for employment is their ability to have greater oral and written communication skills. Based on prior research we included a survey question as to whether the CFE is perceived as having a perceived higher quality of written and/or oral communication. The current mean (45.1%) and the future mean (51.7%) both reflect substantially positive perceptions of communication skills.

### Means

Mean responses to questions (i.e. average of all responses agree and disagree) regarding current perceptions of CFMs are presented in Table 3, Column 1. All means were greater than zero indicating an overall positive response. We

tested each of these means and they are all significantly greater than zero at (<.05). Mean responses to questions regarding expected future perception of GFM are presented in Table 3, Column 2. Again, all means were positive and significantly greater than zero. GFM have favorable future perceptions of quality and career enhancement included in this study and afforded by the CFE designation.

We interpret (1) a positive mean response as evidence of overall agreement with the question, and (2) a negative mean response as evidence of overall disagreement with the question. Collectively, for each of these questions mean responses are positive for all questions. Morgan and Nix (2011) and Morgan, Booker and Chong (2014) had reported that CPA participants perceived a negative mean perception of CFE quality and career enhancements related to advancement, mobility and auditing. Nix and Morgan (2013) Morgan, Booker and Chong (2014) reported that CFOs had all favorable positive responses. We conclude that GFM currently have a favorable perception of the quality and career enhancements presented as questions in this survey and afforded by the CFE certification.

**Table 3: GFM Perceptions of the CFE for Quality and Career – Means Comparison**

<b>GFM Perceptions of the CFE for Quality and Career – Means Comparison</b>			
	<b>Current</b>	<b>Future</b>	<b>Paired t</b>
	<b>Mean<sup>a</sup></b>	<b>Mean<sup>a</sup></b>	<b>test</b>
			<b>Sig. Level</b>
<b>Quality   Career Enhancements</b>			
<b><u>Financial Expertise</u></b>			
<i>Statement Preparation</i>	0.424	0.594	0.000
<i>Systems Development &amp; Implementation   Data Analytics &amp; Cyber Assurance</i>	0.687	0.885	0.000
<b><u>Audit Expertise</u></b>			
<i>Assurance</i>	0.930	0.984	0.565
<i>Fraud Prevention &amp; Detection   Internal Controls</i>	1.491	1.841	0.001
<b><u>Career Mobility</u></b>			
<i>Within Their Organization</i>	0.259	0.609	0.000
<i>To Other Organizations</i>	0.701	0.861	0.000
<b><u>Greater Level of Competency with:</u></b>			
<i>Skill, Knowledge, Ability</i>	0.961	1.203	0.000
<i>Written &amp; Oral Communication</i>	0.423	0.594	0.000
<sup>a</sup> Columns 1 & 2 are means based upon scale of: -2 = Strongly Disagree, -1 = Disagree, 0 = Neither Agree nor Disagree, 1= Agree, 2 = Strongly Agree.			

**Change in Perception - Future versus Current**

Mean difference paired t-test results are presented in Table 3, column 3. The differences used in this measurement are paired-sample difference (each respondent’s future perception minus current perception). Based upon a paired t-test, we determine that most of the mean differences (all but audit assurance) were significantly greater than zero (at a confidence level of .05).

Mean differences for financial elements of statement preparation and IT function were positive and significant. This suggests that GFMs expectation in the future is that there may be greater advantage for person with a CFE who works in a traditional financial reporting position and those who may work in IT. Also, the GFMs may simply believe that an awareness of fraud could be becoming increasingly important to these areas. Mean differences for audit assurance were not significantly different. This indicates that the CFMs believe a contribution a CFE can make to audit work will not later increase. The data here may suggests that the GFMs feel strong about the help CFEs give to auditing and that perception will be consistent into the future. Mean differences related to mobility to top management and mobility to other organizations are both significantly different. This shows that GFMs believe that the value of a CFE related to changing positions and changing jobs (i.e., advancement and mobility) will continue to increase in five years. Perceptions of an overall greater level of competency in skill, knowledge and ability will continue to increase. Perceptions of future value of communication skills is significantly greater than the current perspective.

## **CONCLUSION, FURTHER RESEARCH & LIMITATIONS**

Regulators have responded to fraud with new auditing rules and laws which impose higher standards on auditors and managers which have created greater responsibilities to detect and prevent fraud. The pressure on executives, accounting firms and government agency to control the risk of fraud has increased the demand for professionals with an understanding of fraud. Increased demand for such profession should result in enhanced value of professionals certified in fraud. This study examines perceptions of government financial managers (GFMs) related to the benefits of CFE certification. An understanding of the value added by CFE certification will benefit both users of the services, providers of services and the Association of CFEs. This research provides evidence of value provided by CFE certification.

GFM respondents indicate the CFE is, currently and in the future, expected to provide career advantages and presumptions of quality of services. The certification signals quality related to expertise in financial systems development, audit/assurance and fraud prevention, but less so for statement preparation related to financial reporting. The study also provides evidence that the future perception of the value of CFE certification for financial reporting, and systems, and audit and fraud assurance will remain high. The evidence shows that a significant minority of respondents agree that CFE certification is helpful for mobility, however a majority agree the CFE enhances external mobility. Both of the perceptions mentioned above trended upward indicating a greater value of CFE certification for both internal and external job mobility in the near future. The respondents agree that a CFE signals an overall greater level of competency with skills, knowledge and ability. Respondents agreement is somewhat less for written and oral communication. However, perceptions of the CFE for both of the above-mentioned measures are higher for the near future (5 years). The authors conclude that GFMs have a general favorable image of CFEs and the value of the services of a CFE in the workplace, both current and future.

The ACFE provides a certification that is in demand by the business and accounting professionals. Perceived value is enhanced by marketing the benefits of a certification. The ACFE should continue efforts to inform the public and business professionals of the value of CFE certification and market the certification by focusing on college and university accounting programs. University programs could help to reflect accreditation impact and engagement efforts by adding forensic accounting courses and incorporate an appreciation of fraud certification in accounting courses. Promotion of CFE certification with scholarships and educational programs aimed at accounting majors may significantly enhance the value of CFE certification, as well as an entire accounting program. This study purports that GFMs should encourage hiring of CFEs and should encourage employees' interest in qualifying for CFE certification.

Future researchers may extend the body of research by examining the value of other government related accounting certifications such as the Certified Government Financial Manager (CGFM) and the Certified Public Finance Officer. Additionally, research related to the value of and career enhancement afforded by the Certified Management Accountant (CMA), and Certified Internal Auditor (CIA) and other similar certifications could be repeated and extended.

The findings in this study are subject to limitations. First, this study is limited to perceptions of GFMs. Other users of services provided by CFEs and other stakeholders in the fight against fraud may include but not limited to: (1) human resource directors, (2) internal auditor chiefs, (3) board of director members, (4) state boards of accountancy members and (5) governmental auditors. Perceptions from any one of these groups may enhance understanding of issues related to career opportunities and perceived quality of services, and thus, provide a more detailed assessment of the value of

the CFE certification. This research adds to prior research and provides greater understanding of the benefits of CFE certification. The perceptions of GFMs and the analyses provided by this research should benefit business managers, government managers, accountants, academics and any potential CFE candidates.

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# Reimagining the Introduction to Business Course: Comparison of Two Designs

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## ABSTRACT

With current enrollment decreases and increased cost pressures, recruitment and retention of students is critical. Introductory courses provide a vital platform from which a student may build a successful collegiate career. Introduction to Business (I2B) courses are such courses and provide a great way for even non-business students to gain useful skills.

The study provides insight into historical developments and improvements of such courses, including the use of gamification, simulation, and reflection. It evaluates two I2B course designs, both of which employ a next generation simulation. One design is an online offering at a large institution; the second is a face-to-face offering at a small institution. The purpose of the evaluation is to determine if one design is superior to the other. Explanations for specific design features are provided. The outcome of the study demonstrates that both designs are effective in achieving defined goals, consistent with class size and modality.

**Keywords:** business simulation, introduction to business, pedagogy, gamification, course design, problem-based learning

## INTRODUCTION

Borden (2016) provided that the first experience a student has with initial courses, such as an Introduction to Business (I2B) course, is critical in establishing expectations for a successful collegiate career. Introduction to Business courses provide a broad survey of business concepts to ready students for further business study and also to excite students in terms of the content (Borden, 2016). Thus, in these times of decreasing enrollment and increased cost pressures, recruitment and retention of students is critical, and I2B courses provide a great way for even non-business students to gain business skills, as virtually all individuals need to have some sense of business and organizations (Reynolds 2016). These non-business students may then even decide to minor or even major in business.

The study explores the historical context and improvements in introductory courses, such as I2B courses, including the engagement of simulation and gamification in such courses. Two designs of an I2B course are presented, one as an online offering in a large public institution where the course is highly enrolled, and the other in a small public institution where the course is of low enrollment, both of which employ next generation simulation (NextGen SIM) as a core component of the course. Pedagogical detail is offered for each design as well to provide a clear understanding of similarities and differences in the course delivery. A comparison of these two I2B course designs is made in terms of student perception data to determine if one course design with regard to course enrollments and modality is superior to the other. The study concludes with a subsequent discussion of the results and suggestions for further I2B course evolutions.

This study is important as it seeks to identify if any one design of an I2B course employing NextGen SIM considering course enrollment and modalities is superior to the other, as determined by student feedback. Such information is helpful as students seek flexibility in course modality offerings and institutions of higher learning seek to offer quality courses that allow for flexibility in delivery while simultaneously engaging learners in these critical, introductory courses.

## LITERATURE REVIEW

Borden (2016) identified that the first experience a student has with a course is critical in establishing expectations for a successful collegiate career. These courses provide a broad survey of business concepts to ready students for further business study and also to excite students in terms of the content (Borden, 2016). However, selecting 17 institutes of

higher education (IHEs) from the top 25 undergraduate programs identified in *Bloomberg Businessweek* (Levy and Rodkin, 2016), Borden found wide variation among courses promoted as I2B courses, in contrast to Introduction to Accounting courses, which were much more standard in content. All 17 IHEs required an I2B course for their business students, with the vast majority requiring it within the freshman year, with credits granted from zero to three credits. Variation further existed in terms of professional communication and professional development assignments required. Most courses required some level of teamwork. All had unique but diverse goals, such as problem solving, career choice, leadership, etc. Thus, although this course is considered important, approaches to its design vary widely.

Business knowledge and resultant skills are necessary for all students (Reynolds, 2019), indicating the business students all take liberal arts courses, but liberal arts students are not required to take business courses. However, liberal arts students will clearly need to exercise skills necessary for organizational success, such as critical thinking, problem solving, decision-making, and time management (Reynolds, 2019). Caruso (2019) found that the use of simulations enhances critical thinking, while Hartman et al. (2013) indicated that team approaches to simulation allow for tolerance of ambiguity and stress in decision-making. To this end, designing the I2B course to be palatable to not only business students but to the larger campus study body makes good sense.

As far back as 1973, researchers have been interested in evaluating the benefits of simulation and gamification in course design (Greenlaw and Wyman, 1973). At that time, Greenlaw and Wyman (1973) provided a rather pessimistic view of such design; however, Wolfe (1997) reported positive outcomes regarding simulation and gamification in teaching strategic management. Wolfe further advanced, in a prescient manner, that computer simulations and gamification are indispensable tools for instructors.

In terms of the cognitive level of learning, Despeisse (2018) indicated that although generalizations are difficult with regards to game design, a modified Bloom's Taxonomy should be considered, encompassing these dimensions: 1) remembering, 2) understanding, 3) applying, 4) analyzing, 5) evaluating, and 6) creating. Thus, by understanding the learning objectives to be achieved, an appropriately designed game or simulation can be selected with respect to the taxonomy level sought.

The affective level of learning should encompass the following dimensions in terms of game design: 1) receiving—learning the game and expressed willingness to participate, 2) responding—conforming to the game rules, 3) valuing—internalizing the rules and hence applying them more easily, 4) organizing—combining information and acting accordingly to achieve objectives, and 5) characterizing—being able to apply learning to a real-world application (Despeisse, 2018). Hence, it is imperative to deliver the game or simulation in a way that moves the learner through each phase, as the typical point of simulation is to mimic practical application.

Elliott et al. (2021) offered a menu of games in their publication, covering a variety of business disciplines, including, but not limited to, marketing, accounting, and strategy. They further offer insights into strengthening the simulation/gamification experience, consistent with Despeisse (2018). To fortify learning and achieve the components detailed by Despeisse (2018) and Elliott et al. (2021), a structured approach to the simulation is warranted, including the opportunity for reflection and debriefing. Drawing on a variety of extant literature on learning reflection, Kember et al. (2000) provided a questionnaire offering four ratings of four constructs that are necessary for reflective learning: habitual action, understanding, reflection, and critical reflection. These researchers developed such a tool to encourage instructors to better understand how pedagogical efforts achieved desired learning outcomes.

Teach and Szot (2019) described the usefulness of debriefings and structuring such debriefings to maximize the effectiveness of simulation use. Thus, to achieve adequate curriculum design when using simulation, the literature suggests the need to understand if critically reflective thinking is achieved or enhanced as a result of the simulation pedagogy; the literature further encourages the use of debriefings. Both mechanisms are consistent with facilitating both the affective and cognitive levels of learning. Additionally, the choice of the simulation itself should facilitate affective and cognitive learning levels using critical reflection and debriefing.

In an I2B course then, the simulation should provide a broad foundation across the key disciplines of business, and it should allow for experimentation, fostering critical reflection, and debriefing. For example, the simulation might provide students with a series of challenge scenarios that increase in complexity as students develop their skills, including those associated with quantitative literacy. Importantly, this simulation should allow for students to “re-play” a simulation over and over, according to the professor's direction, facilitating the students' use of reflective critical thinking as well as the opportunity to share successes and opportunities for improvement as part of debriefings

(Nightingale, 2019). Further enhancing the use of the simulation should be a planning phase for the scenario challenge using business quantification techniques, such as Excel spreadsheets, and team reflection on the plan prior to play (Hains et al., 2019).

With regard to modality of delivery, the pandemic offered a large, natural experiment with regard to online delivery. Marcus (2022) indicates that 57% of students are more optimistic about the quality of online courses than before the pandemic, and essentially all IHEs believe utilization of such a modality will increase. The pandemic provided a seismic shift in the acceptance and mastery of using technology, such as Zoom, to facilitate teaching, and as a result, the direction of teaching modality has shifted. Indeed, March (2022) reports that online modality is particularly effective in large introductory courses. Thus, in terms of redesigning I2B courses, attention should be given to course enrollment and student demand for modality.

## **PURPOSE AND RESEARCH QUESTIONS**

The purpose of this study is to determine if one design of an I2B course using a NextGen SIM is superior to another design of the I2B course, also using a NextGen SIM, considering course enrollments and modalities. It is hypothesized that both designs will demonstrate that, after completing the course, students will perceive themselves as better critical thinkers, more engaged in the coursework, more motivated to learn, and having a better understanding of business disciplines that are fundamental to future career paths.

To challenge the hypothesis, the following research questions will be explored:

Research Question 1: Generally, what are the student perceptions of the I2B course in the highly enrolled, online offering regarding critical thinking, engagement, motivation to learn, and business understanding?

Research Question 2: Generally, what are the student perceptions of the I2B course in the lower enrolled, face-to-face offering regarding critical thinking, engagement, motivation to learn, and business understanding?

Research Question 3: Do significant qualitative differences exist between the two I2B designs?

The hypothesis will be considered met if both research questions 1 and 2 demonstrate a preponderance of positivity with regard to the dimensions identified, with positivity defined as agree to strongly agree responses to the questions posed in the methodology section. The last research question is anticipated to show no appreciable differences between the designs, with both designs demonstrating a preponderance of positivity as resulted from research questions 1 and 2.

## **METHODOLOGY**

This study is an exploratory study, utilizing qualitative data. The methodology evaluates student perceptions in two separate I2B courses (one with large course enrollment and offered online; the other with low course enrollment using face-to-face modality) with regards to specific outcomes: impact on critical thinking; impact on course engagement; impact on motivation to learn content; and impact on business discipline understanding.

Ordinal student feedback was collected as part of the end-of-semester evaluations. The ordinal data included several questions, with feedback responses ranging on a five-point scale of strongly disagree to strongly agree. These questions are as follows:

- 1) In this course, my critical thinking increased.
- 2) The simulation exercises helped me be more engaged in the course.
- 3) My motivation to learn and to continue to learn about course topics increased because of this course.
- 4) This course helped me better understand how business disciplines come together within an organization to deliver customer value at a profit.

Each question's responses on the ordinal scale (critical thinking, engagement, motivation, and business understanding) were analyzed via graphical means, with a comparison and contrast of the two designs.

Prior to evaluating the qualitative results, a description of each of the designs follows. Initial information is shared in terms of an overview of each design followed by a more specific description of each design, including pedagogical features.

### **I2B with NextGen SIM Course Designs**

Both I2B courses in this study employed the NextGen SIM ScrimmageSIM and used the Kindle book, *Fundamentals of Business* (Wagner, 2019). The first I2B course represents an online offering at a large public institution, with course enrollment averaging about 500 students per semester. The second I2B course represents a face-to-face offering of the course in a small public institution, averaging 10 students per semester. Both courses are targeted to the entire student body and are not exclusively offered to business students.

The Kindle book pairs with the ScrimmageSIM simulation. The book provides a broad survey of introductory business topics, including strategic planning, leadership, financial statements and literacy, economics, marketing, finance, and operational capacity planning. ScrimmageSIM is designed as a web-based enterprise resource planner (ERP) which allows students to interact with the simulations in an environment similar to that experienced in the workplace (Wagner, n.d.). Faculty members teaching the I2B course select from a menu of simulations supporting the theory from the text, building in complexity. Students work in teams to determine strategies to maximize profit throughout the scenarios. Like other simulations, ScrimmageSIM allows for student engagement with the material and allows for students to compete and learn from each other to achieve optimal results. Uniquely, ScrimmageSIM allows for repetition of the scenarios so students can improve their outcomes (Wagner, n.d.). Lastly, ScrimmageSIM offers the option to have a business scenario built to a faculty member's needs.

In both courses, students are shown how to understand a company by looking at the financial statements, calculating key ratios and comparing these ratios to industry averages. Excel spreadsheets are introduced as a tool for performing these analyses, with the expectation that students will continue to use the spreadsheets as planning mechanisms to optimize success on the scenario challenges. These essential financial topics are covered early in the course to provide a foundation for the other topics covered in the course.

Although similarities exist between the two designs, variations also exist. These two courses are discussed next, beginning with the online highly enrolled course offering.

#### ***I2B: high enrollment, online offering***

The course description for this I2B is:

This course introduces students to key business functions and how they work together to provide customer value and generate profits for a company. Students will gain an understanding of the history and development of business in a free market economy. Students will be introduced to conceptual and quantitative models that help businesses solve problems and evaluate opportunities. Students will develop proficiency in oral and digital communication and information literacy through several classroom experiences and assignments. Students will examine the dynamics of business decision-making and demonstrate the ability to identify, define, and interpret essential business concepts using an integrative business simulation. The simulation will also allow students to understand how information systems are used to manage a business and gain a first-hand understanding of leadership in a small group setting.

The course objectives are:

1. Develop an appreciation of the history and structure of business and economics.
2. Analyze key financial statements through increased fluency with the fundamental concepts of accounting.
3. Develop a fundamental understanding of economics and how economic concepts can be used to better understand the business environment.
4. Describe the strategic management process and its role in managing a company.
5. Describe the role of marketing in helping a company deliver value to the customer.
6. Describe the new product development process and explain its critical role in a company's long-term success.
7. Describe the function of supply chain management and how the different participants in the supply chain coordinate their activities to provide value efficiently.
8. Analyze business problems involving the discounting of cash flows.
9. Apply key concepts of personal financial planning to maintain an individual's financial health.
10. Describe how the business disciplines of management, marketing, accounting, supply chain management, and finance work together within an organization to deliver customer value at a profit.



11. Apply key concepts in leadership and management in a team environment.
12. Apply conceptual and mathematical models to business problems.
13. Build and use Excel spreadsheets to analyze business problems.

This course is a required course for business students at this IHE. However, all enrolled students can take the course, as it meets the university's requirements for Oral and Digital Communications. Options are limited for this requirement, and as such, this course is a popular choice. Students work in teams of three and earn points that represent individual work as well as teamwork. The pedagogy consists of lecture, readings, video, presentation, research, and writing. A description of the assignments is found in Appendix A.

The approach taken in this design is unique, in that it allows students the opportunity to redo as much of the coursework as possible if they have not performed to an acceptable level. As an online offering, the midterm and final exams in the course are online and available from the beginning of the semester. The students can take the exams as many times as they want and their best score counts. Each time the exam is taken, the students receive a random set of true/false and multiple-choice questions from the textbook chapter. For quantitative problems, there are at least two versions of each question, and the question has random values in the question itself. Papers and presentations are graded by communications professionals (through the ScrimmageSIM simulation) and students are given constructive feedback and encouraged to resubmit their work for a better score.

The spreadsheet assignments include an academic integrity macro that prevents the students from submitting other students' work. Again, students can resubmit this work and earn a better score if desired. The intent is that students strategize for an upcoming simulation using an Excel spreadsheet, they meet to discuss and adjust their strategy, and then run the simulation. They separately submit their spreadsheet, although the team runs the simulation as a unit. Their strategy meeting is digitally recorded for grading purposes.

### ***I2B: low enrollment, face-to-face offering***

The course description for this I2B is:

This class is designed to provide you with a foundation for a lifelong career of learning and applying business concepts. An overriding theme of this course is the development of your quantitative literacy in the context of applied business concepts. Quantitative literacy is defined in this class as an aggregation of skills, knowledge, beliefs, dispositions, habits of mind, communication capabilities, and problem-solving skills that people need to autonomously engage in and effectively manage situations in life and at work that involve numbers, quantitative or quantifiable information, or textual information that is based on or has embedded in it some mathematical elements.

The course objectives are:

1. Interpret and draw inferences from mathematical models, such as formulas, graphs, tables, and schematics.
2. Represent mathematical information symbolically, visually, numerically, and verbally.
3. Employ quantitative methods such as arithmetic, algebra, geometry, or statistics to solve problems.
4. Estimate and check mathematical results for reasonableness.
5. Recognize the limits of mathematical and statistical methods.
6. Determine the nature and extent of the information needed.
7. Use information effectively to accomplish a specific purpose, either individually or as a member of a group.
8. Use technology effectively to accomplish a specific purpose, either individually or as a member of a group.

The I2B course is not a required course for business students at this IHE. It is, however, available to all students. It was approved as a foundational course meeting the mathematical and quantitative reasoning requirement.

For its first offering, 11 students were registered. Students work in teams of two and receive grades as both individuals and teams. The pedagogy consists of lecture, readings, video, presentation, and writing. A description of the assignments is found in Appendix B.

This design utilized an approach more focused on the text and simulations themselves. For example, no outside readings are required. Substantial teamwork is required for not only the simulations, but also regarding the post

mortems and One Big Idea presentations (described in Appendix B). This course does not allow for retakes of knowledge checks to improve to best grade. It does, however, allow for reworking simulations for best grades.

## RESULTS

The ordinal data were collected via course evaluations at the end of the Fall 2022 semester as described in the Methodology section. For the high enrollment, online offering, n = 240. For the low enrollment, face-to-face offering, n = 11.

Graphical analyses were performed to ascertain if, after taking the course, students perceived themselves as better critical thinkers, more engaged in the coursework, more motivated to learn, and having a better understanding of business disciplines that are fundamental to future career paths. The analyses will be presented as part of each research question.

Research question 1: Generally, what are the student perceptions of the I2B course in the highly enrolled, online offering regarding critical thinking, engagement, motivation to learn, and business understanding? “Figure 1: High Enrollment, Online Offering Students’ Perceptions of Agreement with Research Questions: Preponderance of Students in Agreement of Positive Impact” provides the graphical analysis of these results:

**Figure 1: High Enrollment, Online Offering Students’ Perceptions of Agreement with Research Questions: Preponderance of Students in Agreement of Positive Impact**

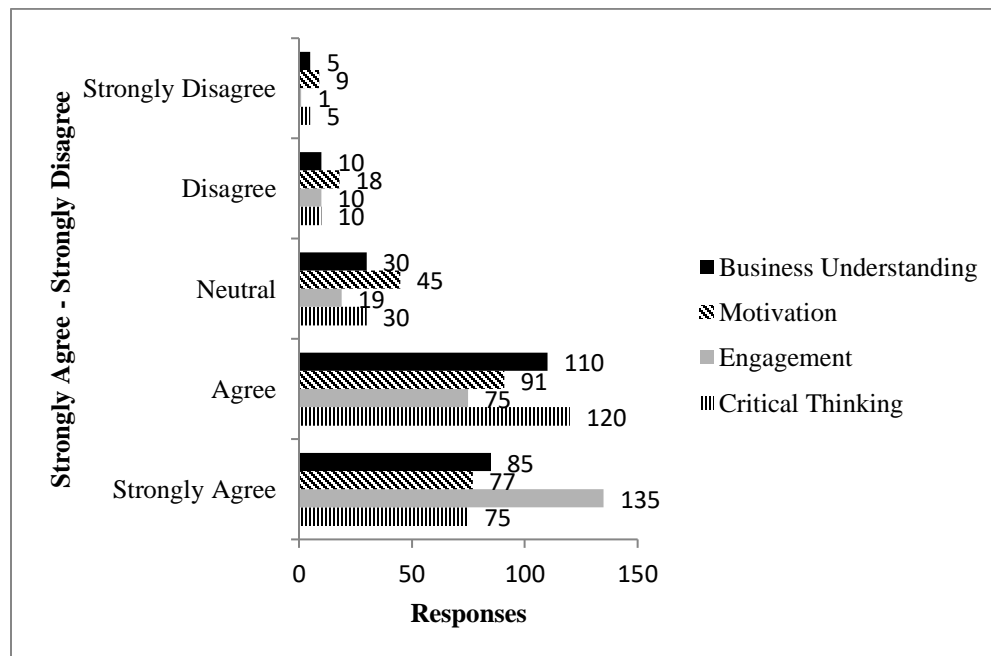
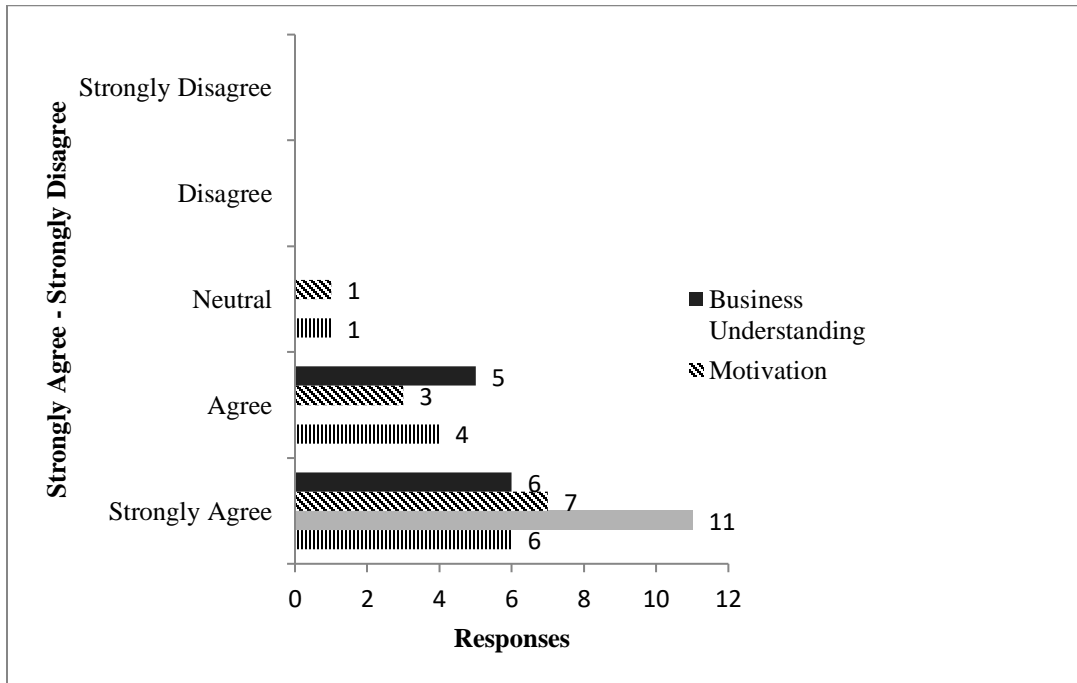


Figure 1 shows that most respondents experiencing this course design perceive positive impacts with improvements in critical thinking, course engagement, motivation to learn content, and advancing their business understanding. When considering percent of strong agreement and agreement responses as positive indicators, critical thinking resulted in 81.3%, engagement resulted in 87.5%, motivation resulted in 70%, and business understanding resulted in 81.3% of total respondents indicating agreement to strong agreement with improvements in these areas.

Research question 2: Generally, what are the student perceptions of the I2B course in the low enrollment, face-to-face offering regarding critical thinking, engagement, motivation to learn, and business understanding? “Figure 2: Low Enrollment, Face-to-Face Offering Students’ Perceptions of Agreement with Research Questions: Preponderance of Students in Agreement of Positive Impact” provides the graphical analysis of these results:

**Figure 2: Low Enrollment, Face-to-Face Offering Students' Perceptions of Agreement with Research Questions: Preponderance of Students in Agreement of Positive Impact**



As with research question 1, Figure 2 shows that the responses to research question 2 demonstrate students' perceived positive impacts with improvements in critical thinking, engagement, motivation, and business understanding. When considering percent of strong agreement and agreement responses as positive indicators, critical thinking resulted in 90.9%, engagement resulted in 100%, motivation resulted in 90%, and business understanding resulted in 100% of total respondents indicating agreement to strong agreement with improvements in these areas.

Research question 3: Do significant qualitative differences exist between the two I2B designs? "Figure 3: High Enrollment, Online Offering versus Low Enrollment, Face-to-Face Offering: Percentage of Participants Indicating Combined Agree - Strongly Agree" illustrates the graphical analysis of these results:

**Figure 3: High Enrollment, Online Offering versus Low Enrollment, Face-to-Face Offering: Percentage of Participants Indicating Combined Agree - Strongly Agree**

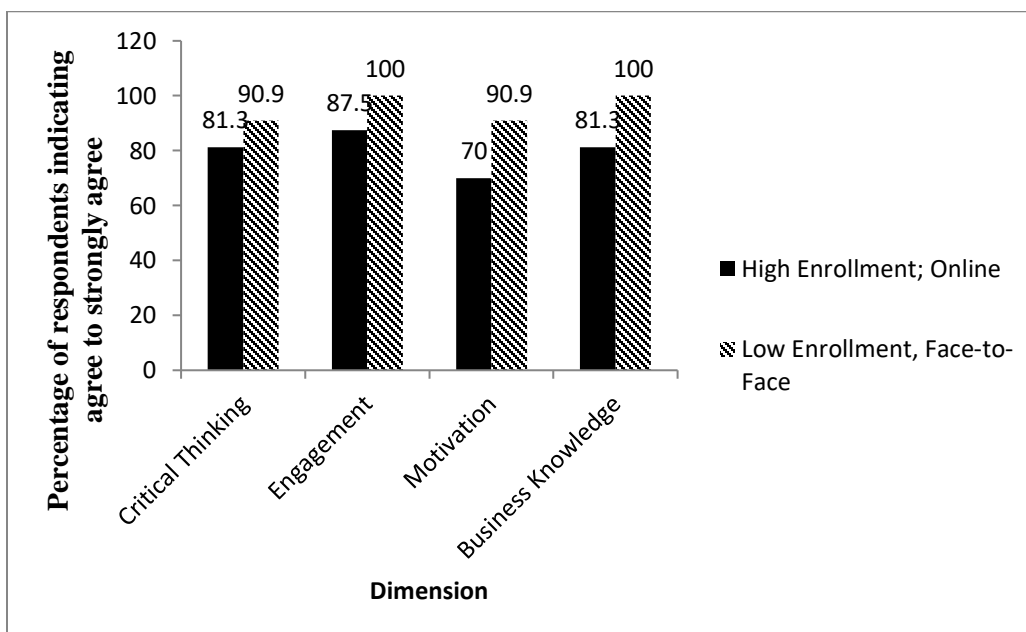


Figure 3 illustrates that both implementations provide for a preponderance of respondents indicating agree to strongly agree regarding each dimension considered. It is noted that the face-to-face, low enrolled course tended to have a higher percentage, and that result may be indicative of the small sample size when compared to the highly enrolled online offering, which provides a much more robust data set.

## DISCUSSION

The analyses associated with each research question indicates that the hypothesis appears acceptable. That is, both designs appear to demonstrate that students will perceive themselves and self-report as better critical thinkers, more engaged in the coursework, more motivated to learn, and having a better understanding of business disciplines that are fundamental to future career paths.

Although both courses utilized simulation, the results of this study are consistent with that found in the literature, specifically Despeisse (2018) who indicated that approaches using gamification and simulation not only promote deeper learning, but also enhance the development of professional skills, such as leadership, teamwork, and communication. As indicated in the results of this research, Despeisse (2018) provided that such an approach must work to enhance a student’s learning experience.

The approaches described in our research are consistent with the structured approach that allows for an opportunity for reflection and debriefing, as promoted by Kember et al. (2000). Additionally, the I2B designs described in this research are aligned with the research of Teach and Szot (2019), who describe the usefulness of structured debriefings to maximize the effectiveness of simulation use as well as an evaluation of critical thinking. Importantly, both designs presented allow for students to “re-play” a simulation over and over, according to the professor’s direction, which further facilitates the students’ use of reflective critical thinking as well as the opportunity to share successes and opportunities for improvement as part of debriefings, notable from the research of Nightingale (2019) and Hains et al. (2019), which are both concerned learning associated with ERP systems. In the online model, this same ability to repeat assessments beyond the simulation for better understanding of the material and higher grade is also consistent with this notion.

Lastly, the findings are also consistent with Marcus (2022), who reported that students, post-pandemic, appear to do well in introductory courses which are offered online. There appears to be no detrimental effect in the online offering of the I2B course which was the subject of this study.

## CONCLUSIONS

In conclusion, Introduction to Business courses with simulation may encourage students in their motivation to learn the material, engage in the course, enhance their critical thinking, and allow for a better understanding of business knowledge as they begin their academic journey, regardless of course enrollment and modality. Although this study is not compared against an I2B course without simulation, the literature does suggest such simulations may be beneficial in enhancing the learning cycle. Consistent with the extant literature on simulation and gamification, it appears critical to content learning to have students be able to “re-play” the simulation for better outcomes and engage in active reflection and re-direction of actions within course assessments.

## LIMITATIONS AND OPPORTUNITIES FOR FURTHER RESEARCH

One significant limitation is that the face-to-face course was of a much smaller sample size than the online offering. Thus, it would be beneficial to implement this course design in a separate similar size university and repeat the study. Additionally, an intra-institution study could also be undertaken, repeating the study in the same university each semester.

An additional limitation is that the course designs both utilized a simulation. To understand more of the role of the simulation, the study should be repeated in the two evaluated modalities against courses that do not use simulation. In that way, an opportunity to isolate the value of simulation may be undertaken.

A third limitation is that the analyses for both designs were representative of one semester. Thus, in both circumstances, the attributes of interest should be monitored over time to evaluate and detect changes in perceptions within the dimensions of interest: critical thinking, engagement, motivation, and business understanding. Although a preponderance of agree to strongly agree was used to judge the course designs, an effort can be made to improve that characterization of positivity once the normal movement of the data is known.

Other avenues of research might include an analysis of competence regarding the performance of business students of these I2B courses as they advance into core business courses; and for students who are not business students, an evaluation might be made if any of those students enroll in other business courses, add business as a minor, or even change or add business as a major. Such an approach may better reflect the impact of the I2B courses, as the research conducted in this study relied on self-reported perceptions. Relatedly, further research could be undertaken into the impact of these designed I2B courses on retention of business students to remain in the major.

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## APPENDIX A: ASSIGNMENT DESCRIPTIONS, HIGHLY ENROLLED COURSE (ONLINE)

### Midterm Learning Exam

A midterm exam will be administered through e-learning. Students can take this exam as many times as they want, and the best score will be used for the student's grade. This exam is designed to help students learn the material and develop their quantitative literacy. Students are allowed to get help understanding how to do problems in the exam—especially from the tutoring center—but they are not allowed to have someone take the exam for them.

This exam is available at the beginning of the semester and the course schedule gives the final date and time available to complete this exam. No late exams will be allowed unless the student can provide documentation of a serious medical, family, or similar problem that prevented them from taking the exam in the time available.

### Final Learning Exam

A comprehensive final exam will be administered through e-learning. Students can take this exam as many times as they want, and the best score will be used for the student's grade. This exam is designed to help students learn the material and develop their quantitative literacy. Students are allowed to get help understanding how to do problems in the exam—especially from the tutoring center—but they are not allowed to have someone take the exam for them.

This exam is available once the midterm learning exam is closed. The course schedule gives the final date and time available to complete this exam. No late exams will be allowed unless the student can provide documentation of a serious medical, family, or similar problem that prevented them from taking the exam in the time available.

### Excel Assignments

There are two Excel assignments at the beginning of the course where the student will be guided in building a spreadsheet. The spreadsheets that students will build are: 1) Grade Calculation Spreadsheet; and 2) Gross Margin Calculation Spreadsheet

### ScrimmageSIM Simulations (4 different simulations assigned)

The simulation is designed to be run in teams, and the experience is much better when experienced with a team where all members contribute and learn from each other. Working in a team enhances the learning experience and reduces the workload.

Being part of a team is a privilege. An effective team requires all team members to participate and contribute. The saying “many hands make for light work” applies here. Student performance on the team will be monitored by the following mechanisms:

- Submission of planning spreadsheets that show effort in developing a production plan.
- Active participation in the recorded team meetings.
- Active participation in the simulation, measured by activity in the simulation and observed engagement in the classroom.

## **Company Financial Statement Analysis and Company Analysis Report**

Students will be assigned a publicly-traded company to research. There will be two submissions for this assignment—the company financial analysis and company analysis report.

The financial analysis will be submitted first and will be a key component of the company analysis report. For this assignment, students will get financial statements for the company from the Securities and Exchange Commission website (<https://www.sec.gov/edgar>). Students will calculate financial ratios for at least the most current two years according to the detailed instructions. This assignment will be submitted through the e-learning dropbox.

The company analysis report will incorporate the financial ratios from the financial analysis assignment and add this to additional information pulled from the company's website, annual reports, and news items on this company. This report analyzes the company's history, strategy, current products, and future plans. Using this information, the student will make a prediction of the company's future performance. This paper must be original research using appropriate resources.

The paper must have the following sections:

- Executive Summary
- Background and Company History
- Current Products and/or Services and Markets
- Company Strategy
- Financial Performance
- Prediction of Future Company Performance

## **APPENDIX B: ASSIGNMENT DESCRIPTIONS, LOW ENROLLED COURSE (FACE-TO-FACE)**

### **ScrimmageSIM Simulations (5 simulations will be run)**

Simulations are scenarios provided through the ScrimmageSIM Business Simulation application. These simulations require preparation of data to appropriately forecast using Excel spreadsheets and result in a variety of reports which are interpreted to maximize profit. Excel spreadsheets must be submitted by each student for strategy assessment prior to the first SIM run—thus, the SIM is graded as a team, while spreadsheets are graded as individuals.

### **Knowledge Checks**

Knowledge checks are digitally administered quizzes that are used to enhance your knowledge of the subject matter covered. These are individual assignments.

### **Presentations**

Postmortems are brief 5- to 7-minute team presentations that provide insight into what went well and what went not so well with the SIM. These presentations are expected to provide you with more insight to try to run the SIM again for an even better result and are done weekly as a team.

One Big Idea presentations are 3- to 4-minute presentations providing insight into the key action that allowed for maximization of profit from any one of the SIM runs and are done weekly as a team.

The Flip Grid assignment uses the Flip Grid application to record a final review of the course. You may then respond to classmates' presentations using the same. This assignment is as an individual.

### **Written Assignments**

The After Action Report is a technical writing report on one of the final SIMs. It is expected this report will use graphs and visuals to convey an overview of the chosen SIM. This is an individual assignment.

The Flip Grid assignment uses the Flip Grid application to record a final review of the course. You may then respond to classmates' presentations using the same. This is an individual assignment.

# Exam Format as a Determinant of Student Success in a Cost Accounting Course

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## ABSTRACT

This paper examines the important role that exam format play in assessing students' performance. Using data collected in an accounting course over four semesters, the results are analyzed to determine if the choice of exam format affect outcomes. The analysis compares performance of students on interim exams in a given format comprised of a combination of multiple-choice and essay/short problem questions, to the student selected exam format of all multiple-choice or all essay/short problem questions for the final exam. The study concludes that the students performed better on the final exam than the interim exams.

**Keywords:** exam format, course assessment tool, accounting education, grading of students, tests and measurements

## INTRODUCTION

With the downward trend in students enrolling in accounting programs, faculty members are under pressure to construct their courses in a way that ensures student success (Lawrence & Taylor, 2000). The structure of a course and the methods of measuring students' success in that course should be so that the typical accounting major will be encouraged to continue in the program and pursue an accounting career after graduation (Siagian & Khan, 2016). According to Siagian and Khan, accounting educators serve multiple purposes for their students as they: help to advance investigative and problem-solving skills, provide the necessary understanding and know-how to excel in the profession, and make certain that actual learning occurs (2016).

Cost accounting concepts can be difficult for some students to master as it deals with a less familiar subject matter that may have not been covered in previous accounting courses. Unlike most introductory accounting courses which focus on financial accounting concepts, cost accounting concentrates more on internal management and managerial accounting concepts. This course can be the first introduction to managerial accounting concepts for some accounting majors but is particularly important as it acquaint students with a comprehensive list of useful managerial decision-making methods (Hillard & Sedaghat, 2020). Some important subject areas covered in this course include budgeting, cost-volume-profit analysis, product costing, capital budgets, and performance evaluation which are essential for assessing a company's performance and its ability to sustain in the long run. However, unlike other intermediate accounting courses where students have had some preliminary exposure to financial accounting concepts in their principles of accounting courses; students' grades in cost accounting tend to be lower due to limited prior knowledge and other factors. Consequently, students have the propensity to be anxious about grades in this course.

An assessment tool is as of equal importance as the coursework itself as it helps to determine students' performance in a course (Greer, 2001). Accounting is a subject matter that is not easily understood by many students, thus students who major in accounting tend to be highly quantitative in their thinking. Since a student's final grade is generally determined by the total points accumulated in a course, most students aim to score the highest points possible on all assignments. With this in mind, students tend to prefer a course assessment tool that they consider easy and will allow them earn the most points possible.

## METHODS

After many semesters of hearing students say that they didn't perform well on an exam because of its format, I decided to test that theory and allow students the ability to select the exam format of their choice for their final exam in my Cost Accounting course. Wood, Klausz and MacNeil (2022) believes that students prefer a multiple-choice question format because it is objective and can be graded with ease and quickness. Simply put, students prefer the multiple-choice format because they perceive it as easier since it offers answer choices for them to select from and causes less anxiety (Zeidner, 2001; Mingo, Chang & Williams, 2018). Conversely, other researchers have found that some students do not like multiple-choice exams because it lessens self-assurance in that it may provide some instant negative feedback (Williams, Wood, Arslantas, & MacNeil, 2021). Essay exams, on the other hand tend to employ a more integrative approach as it forces students to recall and analyze information, then apply and or evaluate a situation to demonstrate understanding of a concept (Mingo, Chang & Williams, 2018).



The assessment tools used in the Cost Accounting course included online homework assignments, in-class quizzes, an individual project, two interim exams and a cumulative final exam. For the purpose of this paper, I will limit the discussion to the last two items. The two interim exams taken by all students were comprised of multiple-choice conceptual and computational questions, essay formatted questions and short problems. For the final exam, each individual student was given the option to select for completion (1) an all multiple-choice conceptual and computational question exam or (2) an exam made up of all essay questions and short problems. The students had to make their selection in advance of the exam date so that sufficient copies of each exam would be on hand. It was also made known to students that there would only be one or two extra copies of both versions of the exam for students who decided to switch exam format. The change had to be made within the first 20 minutes of the two-hour exam to allow time for completion. Upon completion of the exam the students were given a short survey to complete to ascertain if their chosen preferred exam measured up to their expectation. An extra credit problem was given on every exam hence the reason for scores over 100%. Students were also allowed to use a self-prepared notecard with notes and formulas as aid on the final exam.

Following the completion of the cumulative final exam but prior to the posting of grades, students were sent a short survey to complete. This survey was done only in the last semester that I taught the course. Unfortunately, the response rate for the survey was very low at approximately 29%.

## RESULTS

As expected, the majority (at least 75% each semester) of the class choose to take the multiple-choice format exam as shown in the summary table below. However, the students who selected the essay/short problem exam format tended to have a higher score on the exam. This could be due to the subjectivity in grading on this type of exam. Unlike a multiple-choice format where the answer is right or wrong, the grader for an essay/short problem exam is able to read the student's answer or review the solution to the problem and allot points based on how well they believe the student answered the question. Below are the results over the four semesters that I was engaged in this practice.

**Table 1: Summary of Exam Format**

Semester	Total Number of Students	Multiple-Choice Format	Essay/Short Problem Format
Semester I	12	9	3
Semester II	23	18	5
Semester III	20	16	4
Semester IV	14	12	2

**Table 2: Semester I Exam Results**

Grade Distribution	Exam I	Exam II	Final Exam
Highest	105	92	90
Lowest	42	33	60
Mean	66.25	64.61	76.08
Standard Deviation	16.91	15.69	9.76

**Table 3: Semester II Exam Results**

Grade Distribution	Exam I	Exam II	Final Exam
Highest	103	105	101
Lowest	43	43	45
Mean	68.48	71.91	76.13
Standard Deviation	17.10	16.54	6.31

**Table 4: Semester III Exam Results**

Grade Distribution	Exam I	Exam II	Final Exam
Highest	90	100	105
Lowest	51	52	58
Mean	67.35	66.17	71.15
Standard Deviation	11.18	11.86	13.18

**Table 5: Semester IV Exam Results**

Grade Distribution	Exam I	Exam II	Final Exam
Highest	101	103	95
Lowest	45	50	55
Mean	70.93	70.05	73.64
Standard Deviation	17.50	15.25	10.30

From the summary tables it can be determined that the average grade on the final exams exceeded the average for both interim exams by at least three points each semester. Even though the average grade increased on the final exam, the highest grade earned each semester was most likely on the interim exams. To add further, the lowest grade earned also increased on the final exam compared to the interim exams each semester.

Tables 8 through 11 in the Appendix details the exam grades for each student, showing the scores for both the two interim exams and the final exam for each of the four quarters, as well as the student's exam of choice for the final exam. Overall, the final exam scores tended to be higher than the interim exam scores, and students who choose the short problem/essay format exam scored higher on the final exam than those who took the multiple-choice exam format. However, there were a few instances where the final exam scores were lower than those of the interim exams. Correspondingly, there were less occurrences where the multiple-choice format test takers outscored those students who selected the short problem/essay format. Additionally, scores for students who chose the short problem/essay format final exam increased more significantly than students who chose the multiple-choice final exam. Even in instances where the final exam scores declined, it was more drastic for the multiple-choice test takers than for those who selected the short problem/essay version of the exam.

**Table 6: Summary Results for Multiple-Choice Format**

Grade Distribution	Semester I	Semester II	Semester III	Semester IV
Highest	86	93	88	85
Lowest	60	45	53	55
Mean	73.00	72.06	66.75	71.75
Standard Deviation	8.93	14.89	9.27	9.06

**Table 7: Summary Results for Short Problem/Essay Format**

Grade Distribution	Semester I	Semester II	Semester III	Semester IV
Highest	90	101	105	95
Lowest	78	82	73	75
Mean	85.33	90.8	88.75	85.00
Standard Deviation	5.25	6.68	11.76	10.00

When comparing the multiple-choice format final exam results to the short problem/essay format exam results, it can be concluded that students who chose to take the multiple-choice exam scored lower than those who selected the short problem/essay exam. As can be seen in summary tables 6 and 7, the overall average exam grade for the multiple-choice exam taker was about 70% compared to 87% for the short problem/essay exam taker. Moreover, the higher exam scores were earned by those students who took the short-problem/essay exam.

In comparing the overall final exams scores to interim exam I, it can be inferred that students scored higher on the final exam than the interim exams. Upon further examination, as seen in tables 16 through 23, it can be perceived that more students' scores increased than they decreased. Furthermore, students who took the short problem/essay format exam had a higher increase in their scores than students who took the multiple-choice format exam. On the other hand, when there was a decrease in students' scores, it was more common for the multiple-choice format exam takers. In addition, the decrease was generally larger for students who took the multiple-choice format exam than students who took the short problem/essay format exam.

In reference to the results of the survey, the student respondents believed the exam to be fair, and was medium in difficulty. They also believed that they were better prepared knowing the exam format and having the choice in selecting one format over another.

## CONCLUSION

While the overall averages on the final examination are higher compared to the interim exams, the reason for the improvement is not immediately apparent. There are several reasons why the grades on the cumulative final exam may be higher including: familiarity with the material as it was previously assessed, improved study habits that was developed over the course of the semester, method of preparation for a specific exam format and the aid of the note card. Although students are happy to have an input in their learning such as a choice in assessment tool, not all take advantage of that choice and some will choose what they believe to be the easiest option.

The results of this paper would suggest that students are correct in believing that exam format may positively affect performance. However, it should be used with caution since this study was specific to one course and explicit to students studying a particular major. Thus, generalization cannot occur as there are fundamental limitations in this type of research. Additionally, further research is needed to validate these outcomes. Future research could repeat the study to include exit polls to increase the survey response, and expand to other subject areas.

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The author would like to express sincere gratitude to her family and friends for their continued support.

## APPENDIX

**Table 8: Exam Results – Semester I**

Student	Exam I	Exam II	Final Exam	Final Exam Format
1	42	64	<b>88</b>	Problem
2	46	47	<b>90</b>	Problem
3	83	68	68	Multiple-choice
4	55	60	<b>85</b>	Multiple-choice
5	55	92	60	Multiple-choice
6	69	87	78	Multiple-choice
7	105	58	78	Problem
8	65	33	<b>86</b>	Multiple-choice
9	61	63	<b>75</b>	Multiple-choice
10	81	58	70	Multiple-choice
11	58	79	60	Multiple-choice
12	75	67	75	Multiple-choice
Average	66.25	64.61	76.08	
Standard Deviation	16.91	15.69	9.76	

The graded is bolded if the Final Exam grade is the highest of all three exam grades.

**Table 9: Exam Results – Semester II**

Student	Exam I	Exam II	Final Exam	Final Exam Format
1	54	43	48	Multiple-choice
2	69	69	<b>77</b>	Multiple-choice
3	67	79	54	Multiple-choice
4	81	91	77	Multiple-choice
5	53	54	<b>95</b>	Problem
6	79	93	65	Multiple-choice
7	67	75	<b>90</b>	Problem
8	50	68	<b>90</b>	Multiple-choice
9	63	70	45	Multiple-choice
10	70	79	55	Multiple-choice
11	103	52	84	Multiple-choice
12	70	71	<b>101</b>	Problem
13	45	90	73	Multiple-choice
14	50	53	<b>57</b>	Multiple-choice
15	95	61	86	Problem
16	59	63	<b>93</b>	Multiple-choice
17	51	70	<b>72</b>	Multiple-choice
18	43	79	71	Multiple-choice
19	97	95	71	Multiple-choice
20	86	71	<b>93</b>	Multiple-choice
21	57	64	<b>82</b>	Multiple-choice
22	103	105	82	Problem
23	63	51	<b>90</b>	Multiple-choice
Average	68.48	71.91	76.13	
Standard Deviation	17.10	16.54	16.31	

The graded is bolded if the Final Exam grade is the highest of all three exam grades.

**Table 10: Exam Results – Semester III**

Student	Exam I	Exam II	Final Exam	Final Exam Format
1	90	100	<b>105</b>	Problem
2	58	64	<b>68</b>	Multiple-choice
3	83	67	<b>88</b>	Multiple-choice
4	71	60	68	Multiple-choice
5	56	52	<b>60</b>	Multiple-choice
6	75	69	70	Multiple-choice
7	57	63	58	Multiple-choice
8	59	70	<b>93</b>	Problem
9	51	52	<b>53</b>	Multiple-choice
10	86	68	85	Multiple-choice
11	71	67	60	Multiple-choice
12	60	60	<b>63</b>	Multiple-choice
13	75	70	<b>84</b>	Problem
14	79	95	73	Problem
15	59	57	58	Multiple-choice
16	75	63	73	Multiple-choice
17	63	64	<b>68</b>	Multiple-choice
18	61	65	<b>70</b>	Multiple-choice
19	65	64	<b>68</b>	Multiple-choice
20	53	53	<b>58</b>	Multiple-choice
Average	67.35	66.17	71.15	
Standard Deviation	11.18	11.86	13.18	

The graded is bolded if the Final Exam grade is the highest of all three exam grades.

**Table 11: Exam Results – Semester IV**

Student	Exam I	Exam II	Final Exam	Final Exam Format
1	57	52	<b>79</b>	Multiple-choice
2	66	75	<b>78</b>	Multiple-choice
3	53	50	<b>65</b>	Multiple-choice
4	46	62	55	Multiple-choice
5	45	58	<b>63</b>	Multiple-choice
6	101	91	83	Multiple-choice
7	65	69	<b>75</b>	Problem
8	94	50	63	Multiple-choice
9	80	103	78	Multiple-choice
10	66	70	<b>73</b>	Multiple-choice
11	71	72	<b>85</b>	Multiple-choice
12	100	71	95	Problem
13	76	69	64	Multiple-choice
14	73	88	75	Multiple-choice
Average	70.93	70.05	73.64	
Standard Deviation	17.50	15.25	10.30	

The graded is bolded if the Final Exam grade is the highest of all three exam grades.

**Table 12: Changes in Exam Score (Exam I to Final) – Semester I**

Student	Exam I	Final Exam	Difference	Final Exam Format
1	42	88	46	Problem
2	46	90	44	Problem
3	83	68	-15	Multiple-choice
4	55	85	30	Multiple-choice
5	55	60	5	Multiple-choice
6	69	78	9	Multiple-choice
7	105	78	-27	Problem
8	65	86	21	Multiple-choice
9	61	75	14	Multiple-choice
10	81	70	-11	Multiple-choice
11	58	60	2	Multiple-choice
12	75	75	0	Multiple-choice

**Table 13: Changes in Exam Score (Exam I to Final) – Semester II**

Student	Exam I	Final Exam	Difference	Final Exam Format
1	54	48	-6	Multiple-choice
2	69	77	8	Multiple-choice
3	67	54	-13	Multiple-choice
4	81	77	-4	Multiple-choice
5	53	95	42	Problem
6	79	65	-14	Multiple-choice
7	67	90	23	Problem
8	50	90	40	Multiple-choice
9	63	45	-18	Multiple-choice
10	70	55	-15	Multiple-choice
11	103	84	-19	Multiple-choice
12	70	101	31	Multiple-choice
13	45	73	28	Multiple-choice
14	50	57	7	Multiple-choice
15	95	86	-9	Problem
16	59	93	34	Multiple-choice
17	51	72	21	Multiple-choice
18	43	71	28	Multiple-choice
19	97	71	-26	Multiple-choice
20	86	93	7	Multiple-choice
21	57	82	25	Multiple-choice
22	103	82	-21	Problem
23	63	90	27	Multiple-choice

**Table 14: Changes in Exam Score (Exam I to Final) – Semester III**

Student	Exam I	Final Exam	Difference	Final Exam Format
1	90	105	15	Problem
2	58	68	10	Multiple-choice
3	83	88	5	Multiple-choice
4	71	68	-3	Multiple-choice
5	56	60	4	Multiple-choice
6	75	70	-5	Multiple-choice
7	57	58	1	Multiple-choice
8	59	93	34	Problem
9	51	53	2	Multiple-choice
10	86	85	-1	Multiple-choice
11	71	60	-11	Multiple-choice
12	60	63	3	Multiple-choice
13	75	84	9	Problem
14	79	73	-6	Problem
15	59	58	-1	Multiple-choice
16	75	73	-2	Multiple-choice
17	63	68	5	Multiple-choice
18	61	70	9	Multiple-choice
19	65	68	3	Multiple-choice
20	53	58	5	Multiple-choice

**Table 15: Changes in Exam Score (Exam I to Final) – Semester IV**

Student	Exam I	Final Exam	Difference	Final Exam Format
1	57	79	22	Multiple-choice
2	66	78	12	Multiple-choice
3	53	65	12	Multiple-choice
4	46	55	9	Multiple-choice
5	45	63	18	Multiple-choice
6	101	83	-18	Multiple-choice
7	65	75	10	Problem
8	94	63	-31	Multiple-choice
9	80	78	-2	Multiple-choice
10	66	73	7	Multiple-choice
11	71	85	14	Multiple-choice
12	100	95	-5	Problem
13	76	64	-12	Multiple-choice
14	73	75	2	Multiple-choice

**Table 16: Exams with Increase Scores (Exam I to Final) – Semester I**

Student	Exam I	Final Exam	Difference	Final Exam Format
1	42	88	46	Problem
2	46	90	44	Problem
4	55	85	30	Multiple-choice
5	55	60	5	Multiple-choice
6	69	78	9	Multiple-choice
8	65	86	21	Multiple-choice
9	61	75	14	Multiple-choice
11	58	60	2	Multiple-choice
12	75	75	0	Multiple-choice

**Table 17: Exams with Increase Scores (Exam I to Final) – Semester II**

Student	Exam I	Final Exam	Difference	Final Exam Format
2	69	77	8	Multiple-choice
5	53	95	42	Problem
7	67	90	23	Problem
8	50	90	40	Multiple-choice
12	70	101	31	Multiple-choice
13	45	73	28	Multiple-choice
14	50	57	7	Multiple-choice
16	59	93	34	Multiple-choice
17	51	72	21	Multiple-choice
18	43	71	28	Multiple-choice
20	86	93	7	Multiple-choice
21	57	82	25	Multiple-choice
23	63	90	27	Multiple-choice

**Table 18: Exams with Increase Scores (Exam I to Final) – Semester III**

Student	Exam I	Final Exam	Difference	Final Exam Format
1	90	105	15	Problem
2	58	68	10	Multiple-choice
3	83	88	5	Multiple-choice
5	56	60	4	Multiple-choice
7	57	58	1	Multiple-choice
8	59	93	34	Problem
9	51	53	2	Multiple-choice
12	60	63	3	Multiple-choice
13	75	84	9	Problem
17	63	68	5	Multiple-choice
18	61	70	9	Multiple-choice
19	65	68	3	Multiple-choice
20	53	58	5	Multiple-choice

**Table 19: Exams with Increase Scores (Exam I to Final) – Semester IV**

Student	Exam I	Final Exam	Difference	Final Exam Format
1	57	79	22	Multiple-choice
2	66	78	12	Multiple-choice
3	53	65	12	Multiple-choice
4	46	55	9	Multiple-choice
5	45	63	18	Multiple-choice
7	65	75	10	Problem
10	66	73	7	Multiple-choice
11	71	85	14	Multiple-choice
14	73	75	2	Multiple-choice

**Table 20: Exams with Decrease Scores (Exam I to Final) – Semester I**

Student	Exam I	Final Exam	Difference	Final Exam Format
3	83	68	-15	Multiple-choice
7	105	78	-27	Problem
10	81	70	-11	Multiple-choice



**Table 21: Exam with Decrease Scores (Exam I to Final) – Semester II**

Student	Exam I	Final Exam	Difference	Final Exam Format
1	54	48	-6	Multiple-choice
3	67	54	-13	Multiple-choice
4	81	77	-4	Multiple-choice
6	79	65	-14	Multiple-choice
9	63	45	-18	Multiple-choice
10	70	55	-15	Multiple-choice
11	103	84	-19	Multiple-choice
15	95	86	-9	Problem
19	97	71	-26	Multiple-choice
22	103	82	-21	Problem

**Table 22: Exam with Decrease Scores (Exam I to Final) – Semester III**

Student	Exam I	Final Exam	Difference	Final Exam Format
4	71	68	-3	Multiple-choice
6	75	70	-5	Multiple-choice
10	86	85	-1	Multiple-choice
11	71	60	-11	Multiple-choice
14	79	73	-6	Problem
15	59	58	-1	Multiple-choice
16	75	73	-2	Multiple-choice

**Table 23: Exam with Decrease Scores (Exam I to Final) – Semester IV**

Student	Exam I	Final Exam	Difference	Final Exam Format
6	101	83	-18	Multiple-choice
8	94	63	-31	Multiple-choice
9	80	78	-2	Multiple-choice
12	100	95	-5	Problem
13	76	64	-12	Multiple-choice

#### Post Cumulative Final Exam Survey

1. How would rate the exam? Easy, medium or hard
2. Do you believe that the exam was fair?
3. Did you feel prepared for the exam knowing the exam format in advance?
4. If given the choice, would you have preferred to select the format for the interim exams?

# **Business Student Personality Profiles: Using TIPI for Advising and Course Design in Business Education**

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## **ABSTRACT**

This research explores the association between personality types, the selection of undergraduate business majors, and the pedagogical preferences of students. It uses a simple, convenient, Ten-Item Personality Inventory (TIPI) to identify an individual's five-factor model (FFM) personality attributes (extroversion, agreeableness, conscientiousness, emotional stability, and openness to new ideas). Business majors are classified into person-oriented, thing-oriented, and both or other majors. Person-oriented individuals scored higher on extroversion, agreeableness, and openness to new ideas. Thing-oriented individuals scored higher on conscientiousness. This research also explores how personality traits affect preferences for different pedagogical designs. Four pedagogical aspects are examined: class size, class delivery mode (typically assigned by administration), course assignment structure, and use of in-class time (generally under the purview of instructors). The two personality traits that most affect pedagogical preferences are extroversion and conscientiousness. TIPI can be used to personalize more advising, course administration, and course design.

**Keywords:** business education, personality profile, personality tests, TIPI, advising, classroom teaching

## **INTRODUCTION**

Throughout history, humanity has been interested in personality characteristics. In the 3<sup>rd</sup> century BC, Greek physician Hippocrates described four temperaments that suggest personality types: sanguine, choleric, melancholic, and phlegmatic (Merenda, 1987). Over the past hundred years, interest in personality types has exploded, with many researchers developing competing personality profiling models and measurement tools. Some prominent 20<sup>th</sup>-century models include Myers-Briggs, developed in 1918 (Myers and Myers, 1995), Minnesota Multiphasic Personality Inventory developed in 1943 (Schiele et al., 1943); and the model used in this paper, the Five Factor Approach developed in the 1960s (Tupes and Cristal, 1961). Over the years, each of these models has been intensely studied, and the inventory tools used to identify individual attributes of each model have been further developed and validity tested.

This paper examines business students' five-factor personality traits as revealed through the Ten-Item Personality Inventory (TIPI). This research aims to understand the association between different personality traits and business majors of study. Additionally, we examine pedagogical preferences as they relate to personality traits. Ultimately, we hope these results will help business advisors direct students toward majors compatible with their personality traits so that they can be successful and happy in their careers. Additionally, we hope this research will shed light on course design, both from an administrative perspective and from an instructor perspective. This research contributes to the literature by replicating and extending earlier research conducted at non-US business schools.

## **LITERATURE REVIEW**

Personality refers to the long-standing traits that motivate individuals to think, feel, and behave in specific ways. It derives from the word *persona*, which in the ancient world was a mask worn by an actor, not to conceal identity, but to project a specific personality trait of a character. Today it is understood that each person has a unique, long-term, stable personality, formed early in life and not easily changed. Personality can be thought of as the idiosyncratic manner in which one interacts with others and the world around them.

### **Five-Factor Personality Attributes**

The five-factor model (FFM) is a grouping of personality traits developed through factor analysis of verbal descriptors of human behavior. Allport and Odbert (1936) argued there is an evolutionary advantage for humanity in identifying valuable differences between people; natural language will therefore reflect these differences in the number of words

that describe particular personality traits. From linguistic analysis, the Five-Factor Model (FFM) was first introduced in the 1960s (Tupes and Cristal, 1961). It gained popularity in the 1990s through work by Digman (1989, 1990), Goldberg (1990, 1993), and others (Saucier and Goldberg, 1996). Presently, the Five-Factor Model is a common feature in the personality chapter of many introductory psychology textbooks. The five factors include: extroversion, agreeableness, conscientiousness, emotional stability, and openness to new experiences. Early models called emotional stability neuroticism. Although the acronyms OCEAN and CANOE have been used to describe the FFM, there is no significance to the order of the traits. Interestingly, except for openness to new experiences, each personality trait has shown a significant association with unique regions in the brain (DeYoung et al., 2010). Individuals fall along a continuum on each attribute. Costa and McCrae (1992) describe each of the five personality factors. These descriptions are summarized in Table 1.

*Extroversion:* Extroversion captures the degree of sociability, assertiveness, and emotional expression of an individual. High levels of extroversion are associated with outgoing, affectionate, adventurous, and passionate individuals who thrive on engagement with their external environment. They are often perceived as being full of energy, action-oriented individuals who can dominate social settings and be the life of the party. Individuals with low levels of extroversion are identified as introverts or loners. They tend to be more quiet, sober, reserved, and less involved in their external world. Introverts need more alone time than Extroverts and can be overwhelmed by excessive stimulation.

*Agreeableness:* Agreeableness characterizes the degree of cooperativeness or desire for social harmony of an individual. High levels of agreeableness are associated with soft-hearted, helpful, trusting, and empathetic individuals who value getting along well with others. They are good-natured, optimistic individuals. Disagreeable individuals are ruthless, critical, uncooperative, suspicious, and irritable people who place self-interest above getting along with others.

*Conscientiousness:* Conscientiousness measures an individual's competence, self-discipline, and passion for meeting expectations. High measures in this area are associated with individuals who are goal-driven, hard-working, dependable, well-organized, punctual, and persevering. They can be perceived as stubborn and focused. Low conscientiousness is associated with flexibility and spontaneity but can appear impulsive, careless, disorganized, sloppy, negligent, late, and unreliable.

*Emotional stability (Neuroticism):* Emotional stability, first called neuroticism, captures an individual's reaction or tolerance to stress. As used in this paper, high scores in emotional stability imply a calm, even-tempered, self-satisfied, unemotional, secure person. Low scores are associated with an anxious, temperamental, self-pitying, unhappy individual prone to negative emotions. They are more likely to be emotionally reactive, perceiving normal occurrences as threats and minor frustrations as dire situations.

*Openness to new experiences:* Openness captures an individual's appreciation for various experiences, feelings, ideas, etc. Individuals scoring high on openness tend to be imaginable, creative, original, liberal, and independent, with a wide range of interests. They are intellectually curious, sensitive to beauty, and willing to try new things, making them appear to be unpredictable. They are more likely to hold unconventional beliefs. Individuals scoring low on openness tend to be down-to-earth, uncreative, practical, conservative, and conventional, preferring routine over change. They have a lower risk tolerance and are described as pragmatic, sometimes even closed-minded, or dogmatic.

### **Ten-Item Personality Inventory (TIPI)**

Several personality tests have been developed to measure the attributes of the Five-Factor Model. Goldberg (1992) developed the earliest prominent inventory, including a 100-item survey. Costa and McCrae (1992) developed the largest inventory, which included 240 items, taking 45 minutes to complete. Other common inventories included John and Srivastava's 44-item BFI (1999) and Goldberg's 50-item IPIP (2006). These elaborate inventories proved too cumbersome for researchers needing a personality profile metric to be used in conjunction with other research questions. A shorter Ten-Item Personality Inventory (TIPI) was developed using descriptors from other well-established Big Five instruments (Gosling et al., 2003). This personality test consists of 10 pairs of words that measure the degree of the personality trait, one pair for each extreme personality type. Subjects could complete it in a few minutes. Table 2 contains the low and high TIPI word-pairs and how responses are coded.

**Table 1: Individual Attributes of High and Low Scorers on Five-Factor Model Dimensions**

<b>Dimension</b>	<b>High Scorers</b>	<b>Low Scorers</b>
<b>Extroversion</b>	active, passionate, talkative, fun-loving, affectionate, joiners,	passive, reserved, quiet, sober, loner, unfeeling
<b>Agreeableness</b>	good-natured, soft-hearted, trusting, generous, acquiescent, lenient	antagonistic, critical, irritable, ruthless, suspicious, stingy
<b>Conscientiousness</b>	Hard-working, well-organized, punctual, ambitious, persevering	disorganized, negligent, lazy, late, aimless, quitting
<b>Emotional Stability</b>	calm, comfortable, even-tempered, self-satisfied, unemotional	emotional, anxious, temperamental, self-pitying, self-conscious
<b>Openness</b>	imaginative, creative, original, curious, liberal, prefers variety	uncreative, conventional, uncurious, conservative, down-to-earth

TIPI asks participants to assess how much they see themselves in the word-pairs using a 7-point scale. For example, the first question is, "I see myself as Extroverted and Enthusiastic." Participants are instructed to "rate the extent to which the pair of traits applies to you, even if one characteristic applies more strongly than the other." All word-pairs are assessed using the following choices: disagree strongly, disagree moderately, disagree a little, neither agree nor disagree, agree a little, agree moderately, and agree strongly. The high-score word-pairs are scored 1 to 7, with 1 being 'disagree strongly' and 7 being 'agree strongly'. The low-score word-pairs are scored 7 to 1, with 7 being 'disagree strongly' and 1 being 'agree strongly'. The high and low score for each personality factor is added together for a combined TIPI-factor score, which is reported in the results. These scores range from 2 to 14, with a midpoint of 8. A score of 14 on extroversion would mean the high-score word-pair "Extroverted, Enthusiastic" were rated agree strongly (7 points) and the low-score word-pair "Reserved, Quiet" were rated disagree strongly (7 points).

**Table 2: Word-Pairs and Ten-Item Personality Inventory (TIPI) Coding**

<b>Low Score Word-Pairs</b> <i>Coded: 1-Agree strongly through 7-Disagree strongly</i>	<b>Ten-Item Personality Inventory Factors (TIPI)</b>	<b>High Score Word-Pairs</b> <i>Coded: 1-Disagree strongly through 7-Agree strongly</i>
Reserved, Quiet	Extroversion (TIPI-E)	Extroverted, Enthusiastic
Critical, Quarrelsome	Agreeableness (TIPI-A)	Sympathetic, Warm
Disorganized, Careless	Conscientiousness (TIPI-C)	Dependable, Self-disciplined
Anxious, Easily upset	Emotional Stability (TIPI-S)	Calm, Emotionally stable
Conventional, Uncreative	Openness (TIPI-O)	Open to new experiences, Complex

Considerable research has addressed the convergent and discriminant validity relative to these various personality inventories. Empirical evidence supports the convergent and discriminant validity of the TIPI with other more detailed personality inventories (Gosling et al., 2003; Ehrhart et al., 2009; Donnellan et al., 2006; Furnham, 2008). Researchers exploring the effects of personality on other research questions have appreciated the TIPI model's ease, simplicity, and brevity. One limitation of using the TIPI methodology is its inability to measure individual facets of multi-faceted personality constructs. The five personality traits are broad constructs encompassing several related but separable facets. Unlike longer, more elaborate inventories, TIPI does not provide scores for the narrower facet-level constructs. Nonetheless, we selected the Ten-Item Personality Inventory to use in its exact form because of its ease of use for business educators and reasonably high convergent validity.

### **Academic Business Major Selection**

Choosing an academic major can be a daunting yet critical task for students. Research suggests that students who are satisfied with their academic major tend to be happier in their future careers (Logue et al., 2007). Student dissatisfaction can result in poor academic performance and even dropping out of university (Graunke and Woosley, 2005) which can cause significant hardship for the student and the university. Informed advising is critical for student and institutional success. In this study, we examine the relationship between student personality profiles and the majors they selected, with the intended purpose of providing information for undergraduate students and advisors about

tendencies of personalities in specific business majors.

While many researchers have conducted studies on the relationship between personality and vocational interest (Larson et al., 2002; Barrick et al., 2003), few have been directed toward undergraduate business majors. Sawsen et al. (2012) studied 109 French-Canadian undergraduate business students, examining the FFM attributes for differences by majors as categorized by thing-oriented or person-oriented (Graziano et al., 2012). Thing-orientation includes courses where learning focuses on physical objects, numeric data, procedures, and sequential representations and typically includes accounting, finance, and operations management. Person-orientation includes learning oriented toward people and human relationships and often includes management, human resources management, marketing, and management information systems. Sawsen et al. (2012) hypothesized that personality influences the probability of choosing a business major type (thing-oriented versus person-oriented), specifically 1) lower levels of neuroticism, 2) higher levels of extroversion, 3) higher levels of openness to experience, and 4) higher levels of agreeableness, all will be associated with a higher probability of choosing person-oriented majors. See Table 3, top panel, for a summary. Sawsen's results supported all four predictions except extroversion. In this study, we replicate these results using 411 business students from two US business schools and extend the study by examining how personality factors influence preferences for instructional pedagogy.

### **Pedagogical Preferences and TIPI Factors**

Like the selection of career areas, students with different personalities are expected to prefer different learning pedagogies in university. Fallan (2006) suggests relationships between personality and pedagogical preferences. He uses the Myers-Briggs personality model, identifying four temperaments: sensing and perceiving, sensing and judgment, intuition and thinking, and intuition and feeling. Although he suggests a variety of pedagogies that would appeal to these groups, he specifically tests the preference of lecture class format versus problem-based learning using 148 sophomore Norwegian business students. In our research, we examine additional pedagogical preferences, specifically class size (small, 20 to 50 students, or large, over 100 students), class delivery mode (online or in-seat), group or individual assignments, and class structure (lecture format or in-class activities). Class size and delivery mode are often the purviews of administration, whereas assignments and class structures are decisions instructors make. We differentiate student preferences along these dimensions of control. See Table 3, lower panel, for a summary of the expectations presented below.

*Extroversion:* Individuals scoring high on the extroversion factor are expected to desire educational models that include interacting with people and would be more likely to prefer in-seat, small classes that include group projects and in-class activities. Students who score low on the extroversion factor are expected to prefer a lecture format with little interaction between students and instructors and to be more likely to engage in online learning.

*Agreeableness:* Agreeable people are good-natured, optimistic individuals who genuinely empathize with others. This implies that pedagogies allowing for more intimate student interaction would be preferred. Highly agreeable people would be expected to prefer smaller, in-seat classes over larger, online ones.

*Conscientiousness:* Highly conscientious individuals are expected to prefer to work alone. These individuals are driven and, if paired with less-focused students, may end up dissatisfied with the output and/or the process. These independent students are expected to prefer not to engage in learning with others; however, because they care deeply about success, they are expected to prefer smaller classes where individual attention is available from instructors.

*Emotional stability:* High scores in emotional stability imply a calm, even-tempered, secure person, whereas low scores are associated with anxious, temperamental, unhappy individuals. Low-scoring students would be more likely to prefer stable environments found in smaller classes and lecture formats.

*Openness to new experiences:* Students scoring high on openness would be expected to be open to any pedagogical format. Low-scoring students would want a predictable environment, similar to the low-scoring emotional stability students. A predictable environment would be found in lecture format and online classes. High openness would suggest a desire for variation in class with activities,

**Table 3: Predictions of Major and Pedagogical Preferences by Personality Attributes**

	Ten-Item Personality Inventory Factors				
	Extrovert	Agreeableness	Conscientiousness	Emotional Stability	Openness
<b>Selection of Major</b>					
Person-oriented	High-E	High-A		High-S	High-O
Thing-oriented	Low-E	Low-A	High-C		Low-O
<b>Pedagogical Preferences</b>					
Small class size	High-E	High-A	High-C	Low-S	
Large class size	Low-E				
Online classes	Low-E				Low-O
In-seat classes	High-E	High-A			
Group assignments	High-E				
Individual assign.	Low-E		High-C		
Activities in class	High-E				High-O
Lecture format	Low-E			Low-S	Low-O

**METHOD**

**Sample**

The survey was administered across an academic year at two medium-to-large, Midwest, AACSB-accredited public universities in a sophomore managerial accounting course and a senior capstone management strategy class. Both classes were required for all business students. The sophomore class could include nonbusiness students, but the capstone strategy class contained exclusively business majors about to graduate. A total of 476 students started the survey in Qualtrics. 65 students did not complete the personality inventory and the area of study (major), leaving 411 usable responses. Nine students did not complete all the pedagogical preference questions. These observations were not eliminated from the whole sample but were excluded from the specific analysis of the missing pedagogical preference.

Table 4 provides information about the self-reported majors for the subjects. Students could select up to two majors from the list presented in the table. 152 (37%) students identified more than one major. Majors were classified as person-oriented, thing-oriented, or other. The person-oriented majors include marketing, human resource management, international business, and entrepreneurship. The thing-oriented majors include finance, accounting, management information systems, supply chain management, distribution and logistics, and operations management. These are the same classification used by Sawsen et al. (2012). Economics, general business, and general management were unclear in their orientation and were listed as undetermined. Sawsen et al. (2012) included economics as a thing-oriented major. We chose not to define it as either thing- or person-oriented because economics majors at our universities include liberal arts and business-oriented students and it is unclear the orientation of these programs of study. When students reported two majors from the same classification type, the observation was classified as that type. When students reported two majors from different classification types, the observation was classified as both and included in a third category, Both/Other, with the undetermined majors. The sample consisted of 130 person-oriented majors, 170 thing-oriented majors, and 111 Both/Other majors.

**Table 4: Academic majors reported by subjects\***

	Number of Respondents selecting this major	% of total subjects	Sample size
<b>Person-oriented majors</b>			
Marketing	124	30%	
HRM	22	5%	
International business	7	2%	
Entrepreneurship	11	3%	
Total person-oriented subjects			130
<b>Thing-oriented majors</b>			
Finance	96	23%	
Accounting	60	15%	
Management information systems	23	6%	
Supply Chain Management	39	9%	
Distribution and logistics	4	1%	
Operations management	6	1%	
Total thing-oriented subjects			170
<b>Both/Other majors</b>			
Double majors from both major types	29	7%	
Undetermined majors			
Economics	29	7%	
General Business/Management	70	17%	
Other nonbusiness	72	18%	
Total Both/Other subjects			<u>111</u>
<b>Total usable responses</b>			411

\* Of the 411 usable responses, 259 reported one major, and 152 reported two majors. Double majors within the same major type were included in that type. Double majors that crossed major types were categorized as both. Some majors identified were classified as undetermined because they did not clearly fall into the person-oriented or thing-oriented category.

### Survey Instrument

To maintain consistency with the TIPI questions, all additional survey question response choices used the same 7-point Likert scale: 1=disagree strongly, 2=disagree moderately, 3=disagree a little, 4=neither agree nor disagree, 5=agree a little, 6=agree moderately, and 7=agree strongly. Students first responded to the 10 TIPI word-pairs from Table 2 and then assessed their agreement with the pedagogical statement list below. The names in parentheses are how these responses are reported in subsequent tables.

- I prefer small classes of 20-50 students (Small class size or Small).
- I prefer large classes of over 100 students (Large class size or Large).
- I prefer fully online classes (Fully Online or Online).
- I prefer fully in-seat classes (Fully In-seat or In-seat).
- I prefer doing projects or homework in groups (Group assignments or Group activities).
- I prefer doing projects or homework on my own (Individual assignments or Individual activities).
- I prefer doing activities or exercises in class (Activities in class or Activities).
- I prefer lecture format in class (Lecture format or Lecture).

In addition, students were asked about their major(s), their year in school, and when they expected to graduate. The survey took less than five minutes to complete for 85% of all participants.

## ANALYSIS AND RESULTS

### TIPI Factor and Orientation Type

Descriptive statistics for TIPI factor scores by major type: person-oriented, thing-oriented, Both/Other, and all majors are presented in Table 5. The theoretical range for TIPI values is 2 to 14, implying a midpoint of 8. However, the mean and median scores for each TIPI factor for the whole subject pool were larger than eight, implying students rated themselves more highly on these dimensions. Extroversion, the most neutral factor, was rated closest to eight. The data were examined for normality using the Jarque-Bara test statics. When the data were analyzed as a whole, the null hypothesis of normal data was rejected for extroversion, conscientiousness, and openness. However, when the sample was divided into orientation types, only conscientiousness remained significantly different from normal data. Thus, parametric tests are used.

**Table 5: Descriptive Statistics of TIPI Factor Scores by Major Orientation Type**

TIPI Factor	Mean	St.Dev.	Min Value	First Quartile	Median	Third Quartile	Max Value	Jarque-Bara Test Statistic
<b>Person-oriented majors (n=130)</b>								
Extroversion	9.038	3.144	2	7	9	12	14	4.135
Agreeable	9.469	1.869	5	8	9	11	14	0.559
Conscientiousness	11.262	2.236	5	10	12	13	14	<b>14.115*</b>
Emotional Stability	8.738	2.361	2	8	9	10	14	1.228
Openness	10.669	2.021	6	9	11	12	14	5.523
<b>Thing-oriented majors (n=170)</b>								
Extroversion	8.288	3.189	2	6	8	11	14	5.714
Agreeable	8.694	2.197	3	7	8.5	10	14	0.795
Conscientiousness	11.400	2.394	5	10	12	13	14	<b>20.066*</b>
Emotional Stability	9.106	2.647	3	7	9	11	14	2.171
Openness	9.400	2.257	3	8	9.5	11	14	1.895
<b>Both/Other majors (n=111)</b>								
Extroversion	8.946	3.162	2	6	9	12	14	4.919
Agreeable	9.360	2.004	4	8	9	11	14	1.671
Conscientiousness	11.045	2.333	5	9	12	13	14	<b>8.293*</b>
Emotional Stability	8.955	2.903	3	7	9	11	14	2.957
Openness	10.468	2.165	5	9	11	12	14	2.840
<b>All majors (n=411)</b>								
Extroversion	8.703	3.179	2	6	9	11	14	<b>14.659*</b>
Agreeable	9.119	2.073	3	8	9	11	14	0.518
Conscientiousness	11.260	2.328	5	10	12	13	14	<b>40.587*</b>
Emotional Stability	8.949	2.632	2	7	9	11	14	4.558
Openness	10.090	2.233	3	9	10	12	14	<b>10.144*</b>

\*Jarque-Bara statistic significant for non-normality at  $\alpha > .01$ .

Table 6 presents the correlations between TIPI factors for all student subjects. The largest two TIPI factor correlations were between extroversion and openness at 28% and conscientiousness and emotional stability at 21%.

Table 7 presents results for two-groups difference of means tests for each TIPI factor, between person- and thing-orientation. As predicted in Table 3 and Sawsen et al. (2012), person-oriented individuals scored higher on extroversion, agreeableness, and openness than thing-oriented individuals. Contrary to Sawsen et al. (2012), our results did not support a difference in the agreeable factor. However, our results did support the extroversion prediction, whereas Sawsen et al. (2012) did not. These differences may have resulted from sampling in the United States versus Canada. Regardless, both studies support the argument that personality traits affect the selection of an academic major.



**Table 6: Correlation between TIPI Factors**

TIPI Factor	TIPI-E	TIPI-A	TIPI-C	TIPI-S	TIPI-O
Extroversion (TIPI-E)	1.000				
Agreeable (TIPI-A)	-0.055	1.000			
Conscientiousness (TIPI-C)	-0.006	-0.016	1.000		
Emotional Stability (TIPI-E)	0.145	0.043	0.211	1.000	
Openness (TIPI-O)	0.282	0.122	-0.019	0.038	1.000

**Table 7: Mean Differences for Major Types by TIPI Factor**

TIPI Factor	Person-oriented Major (n=130)	Thing-oriented Major (n=170)	Mean Difference	T Stat
Extroversion	9.038	8.288	0.750	2.035*
Agreeable	9.469	8.694	0.775	3.297***
Conscientiousness	11.262	11.400	-0.138	-0.515
Emotional Stability	8.738	9.106	-0.367	-1.267
Openness	10.669	9.400	1.269	5.123***

\*T-statistic significant at alpha > 0.05. \*\*\*T-statistic significant at alpha > 0.001

### Pedagogical Choice and TIPI Factor Analysis

The distribution of responses to pedagogical choices is provided in Table 8. These students generally prefer in-seat classes over online classes, individual assignments over group assignments, and larger classes over smaller ones. However, none of these differences were significant at alpha > 0.05. The result that students preferred larger classes over smaller ones was surprising but may be an artifact of the universities examined. An important conclusion from Table 8 is that student preferences vary considerably, implying that one educational model does not fit all students.

**Table 8: Sample Distribution of Pedagogical Choices\***

Pedagogical Choice	Mean	St.Dev.	Min Value	First Quartile	Median	Third Quartile	Max Value
<b>Administration Decisions</b>							
Small class size	5.182	1.246	1	5	5	6	7
Large class size	6.000	1.660	1	5	6	7	7
Fully Online	3.189	2.102	1	1	3	5	7
Fully In-seat	5.426	1.754	1	4	6	7	7
<b>Instructor Decisions</b>							
Group assignments	3.816	1.915	1	2	4	5	7
Individual assignments	5.167	1.545	1	4	5	6	7
Activities in class	5.665	1.410	1	5	6	7	7
Lecture format	5.182	1.512	1	5	5	6	7

\***Response choice:** (7-point Likert scale) where 1-disagree strongly, 2-disagree moderately, 3-disagree a little, 4-neither agree nor disagree, 5-agree a little, 6-agree moderately, and 7-agree strongly.

Table 9 is a presentation of the correlation between pedagogical preferences. As expected, there is a large inverse relationship between preferences for large and small classes ( $r=-36.4\%$ ), for online and in-seat courses ( $r=-49.9\%$ ), and for group and individual assignments ( $r=-29.5\%$ ). In-seat students seem to prefer small class sizes ( $r=29.4\%$ ). Activities in class are correlated with small class size ( $r=40.7\%$ ), in-seat class ( $r=29.3\%$ ), and group assignments ( $r=27.5\%$ ). Lecture format is correlated with small class sizes ( $r=25.5\%$ ) and in-seat courses ( $r=35.7\%$ ). These results suggest that students took the survey seriously.

**Table 9: Correlation between Pedagogical Choices**

	Small	Large	Online	In-seat	GroupA	Indiv.A	Activity	Lecture
<b>Administration Decisions</b>								
Small class size	1.000							
Large class size	-0.364	1.000						
Fully Online	-0.152	0.106	1.000					
Fully In-seat	0.294	0.024	-0.499	1.000				
<b>Instructor Decisions</b>								
Group assignments	0.154	-0.043	-0.115	0.128	1.000			
Individual assignments	0.087	0.096	0.187	0.033	-0.295	1.000		
Activities in class	0.407	-0.082	-0.239	0.293	0.275	0.010	1.000	
Lecture format	0.255	0.087	-0.230	0.357	0.071	0.121	0.164	1.000

Table 10 presents the correlation between TIPI factors scores and pedagogical preferences. Correlations between pedagogical preferences and major orientation-type were not reported because they were all less than 8%.

**Table 10: Correlation between Pedagogical Choices and TIPI Factors**

	TIPI-E	TIPI-A	TIPI-C	TIPI-S	TIPI-O
<b>Administration Decision</b>					
Small class size	0.036	0.141	0.190	0.053	0.084
Large class size	-0.018	-0.124	-0.148	-0.111	-0.025
Fully Online	-0.136	0.022	-0.027	-0.037	-0.066
Fully In-seat	0.075	0.056	0.045	0.096	0.036
<b>Instructor Decision</b>					
Group assignments	0.278	-0.007	0.006	0.131	0.134
Individual assignments	-0.148	0.053	0.167	-0.036	-0.047
Activities in class	0.158	0.017	0.066	0.053	0.115
Lecture format	-0.030	0.017	0.106	-0.040	0.011

OLS regression models for each pedagogical choice were run using various combinations of the five TIPI variables, with and without dummy variables for the major orientation type. The best model using ANOVA F-statistic was selected and is presented in Table 11. These models were confirmed by Adjusted R-square and cross-reference with correlations presented in Table 10. When orientation type was included in the models, both alone and with TIPI factors, these variables were not significant and, thus, have not been presented.

Taken together, Tables 10 and 11 provide evidence supporting the following predictions in Table 3.

- Extroverts prefer in-seat classes, group assignments, and in-class activities over online classes, individual assignments, and lecture formats. This TIPI factor affected more pedagogical choices than the other factors.
- Agreeable persons prefer small classes over larger ones.
- Conscientious persons prefer small classes and individual assignments. They do not like large classes.

The data does not support the following predictions from Table 3:

- Extroverts did not demonstrate a preference for large or small class sizes.
- Agreeable persons did not report preferring in-seat classes.
- The results for conscientious persons demonstrated positive support for both activities and lectures in class. This was not predicted and can be understood if these individuals like education in general.
- Emotional stability did not significantly influence the models of pedagogy choices, except for group assignments. As predicted, small class sizes and lecture format were not related to low emotional stability.
- Openness did not affect pedagogical choices; despite that, it was expected to be positively associated with activities in class and negatively with lecture format and online classes.

**Table 11: OLS Models of Pedagogical Choices by TIPI Factor**

	Models of Various Pedagogical Choices*							
	Small	Large	Online	In-seat	GroupA	Indiv.A	Activities	Lecture
Intercept	3.641 <sup>+</sup> (7.80)	5.321 (9.41)	4.562 (6.32)	4.633 (12.80)	1.889 (4.92)	4.581 (10.72)	3.893 (8.13)	4.396 (10.36)
Extroversion			-0.084 (-2.47)	0.037 (1.34)	0.149 (5.13)	-0.064 (-2.72)	0.049 (2.17)	-0.018 (-0.76)
Agreeableness	0.081 (2.80)	-0.090 (-2.28)						
Conscientiousness	0.104 (4.03)	-0.083 (-2.34)	-0.030 (-0.68)			0.101 (3.14)	0.073 (2.48)	0.082 (2.54)
Emotional Stability		-0.046 (-1.45)		0.051 (1.54)	0.071 (2.02)			
Openness	0.044 (1.65)		-0.030 (-0.61)				0.049 (1.53)	
ANOVA								
F-stat	9.268	5.021	2.820	2.472	17.135	8.791	5.194	3.538
Significance	0.000	0.002	0.039	0.086	0.000	0.000	0.000	0.030

<sup>+</sup> Variable coefficient value reported above t statistic in italics and parentheses below.

## CONCLUSION

The purpose of this research was to provide guidance to business advising, administration, and instructors. When faced with a student who is clueless about selecting a business major, advisors can administer the simple TIPI and use these results to start the process of helping students explore career options that will be personally satisfying. Students who score high on extroversion, agreeableness, and openness to new ideas may be better served in a person-oriented career path, such as marketing, human resource management, or entrepreneurship. Persons scoring high on conscientiousness and lower on agreeableness and openness to new ideas may thrive more successfully in a thing-oriented profession, such as accounting, finance, or operations. Obviously, this simple test cannot provide definitive guidance; it is intended to be a starting point or be used to confirm suspicions, particularly for students at the extremes of these personality factors.

For administrators who make choices about class size and delivery mode, this research suggests that one size does not fit all. When possible, students should have the opportunity to select from large and small classes and in-seat and online delivery modes. The blend of these choices will depend on the university resources, student body, and other factors; however, this research shows that options are important. The data did not support pedagogical differences by major-orientation type and thus cannot be used to guide specific discipline choices.

When instructors are designing business classes, again variety is important. Some students thrive on group assignments and in-class activities, whereas others prefer individual assignments and lecture format. It may be important to offer options to students, such as you can complete the assignment in a group or by yourself. Recent shifts in pedagogy have trended toward group activities and assignments. Is this due to opinions voiced by louder, more extroverted students? This research shows that there are some who want to learn independently.

**Limitations and extensions.** This study was conducted at universities that attract certain types of students and offer particular kinds of classes. Although each type of class is offered at both universities, the results, particularly regarding pedagogy, may not be generalizable to other university settings. There remain considerable opportunities to learn more about career success for business students of differing personality traits as it relates to academic major selected. Another vital area for future research would be to use personality traits to help identify students at risk for underperformance in business classes. Finally, research into best practices for using TIPI scores for advising and pedagogical choices in business education would be a welcome extension of this research.

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# Assessing Disruptive Innovation Research in Management: A Bibliometric Analysis

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## ABSTRACT

In today's competitive business environment, innovation is fundamental to entrepreneurial success and productivity. Business schools (B-Schools) play a significant role in preparing future entrepreneurs and leaders with tools that are essential to advancing innovation across various industries. This Bibliometric study provides an analysis of the performance of disruptive innovation research done by B-Schools in the USA. Using the Web of Science Social Science Citation Index SSCI database, we constructed a dataset comprising of 75 publications on disruptive innovation research in the business management discipline, for the period 2011-2022. These 75 publications were cited 3,024 times and represented the scholarly work of 195 authors affiliated with 213 institutions. The number of publications increased by 11.5% while the frequency of citations increased from 159 to 19,397, representing an approximately 12,000% increase. Based on citation analysis, a top 5 most influential publications list was constructed and emerging themes as well as research trends were identified. The results point to niche themes that are global and go beyond management, giving rise to a future research agenda around disruptive innovation and implications for B-schools.

**Keywords:** Disruptive innovation, Faculty Scholarship, B-Schools, Bibliometric Analysis

## INTRODUCTION

Innovation is vital to the economic development and successful performance of organizations in today's competitive business environment. Transformative revolutions across all industries have been associated with elements of disruptive innovation, and firms in those industries that ignore the underlying currents of disruptive innovation (DI) do so at their own peril. Admittedly, the term 'disruptive innovation' has been widely used in many sectors throughout the years since it was first coined by Christensen (Christensen and Bower 1995; Christensen, 1997), but at times, it has been misunderstood (Christensen, 2016). Although it is common to read or hear frequently about the terms "innovation" and "disruptive innovation" in various settings, the proliferation of research studies on the latter subject has been less than modest over the last 17 years. A search in the Clarivate's SSCI database from 2011 to 2022, using the same parameters of the sample used in this study, returned 34,797 articles on innovation compared to only 75 articles on disruptive innovation.

The Bibliometric analysis in this study addresses the following three research questions: (1) what are the characteristics of the types of DI research in the field of business management? (2) What are the annual publications and citation frequency trends of DI in the field of business management? (3) What are the most influential studies on DI in the field of business management? The purpose of this study was to assess the DI research in the field of business management by conducting a Bibliometric analysis of business journals, specifically dedicated to disseminating a diverse wealth of innovation knowledge. Through bibliometric analysis, this study is intended to gain an understanding of the core research streams and evolution of trends on DI research as well as the kinds of opportunities these trends, over the last 12 years, may present to how this subject is delivered and embraced in B-schools.

## LITERATURE REVIEW

Different scholars have defined innovation in various ways allowing for multiple interpretations depending on the context. Beginning with Schumpeter (1934), innovation has continued to engage the attention of the academy and practitioners over the decades with no signs of abating. In Schumpeter's theory of economic development, innovation is conceptualized through the notion of 'creative destruction'. Disruptive innovation, popularized by Christensen (1995;1997), introduced the term narrowly by using the terms disruptive technological change and disruptive technological innovations. While not all innovations are disruptive, the relationship between innovation and disruptive innovation is a subject of much debate in the innovation literature (Gobbles 2016; Liversidge, 2015; Markides, 2006).

## **Disruptive Innovation**

The literature is replete with the role of disruptive innovation across myriad industries. In 1995, Bower and Christensen in their seminal work, *Disruptive Technologies*, introduced the theory of disruptive innovation, which examined factors driving behind the eventual demise of some top firms in the disk-drive industry. The narrow notion of ‘disruptive technology’ is used by the authors to chronicle and analyze these failures. By 2003, Christensen, in *The Innovator’s Dilemma*, modified his framework of disruptive technologies to include DI, which is defined as “an innovation that makes a complicated and expensive product simpler and cheaper and therefore attracts a new set of customers” (Christensen & Raynor, 2003, p. 15). The DI principles advanced by Christensen promised to assist multiple actors including managers, consultants, and academics who work across different industries, all susceptible to disruption. In 2015, twenty years after the introduction of the concept, Christensen, Raynor, and McDonald revisited the theory of disruptive innovation to clarify and refine the key tenets of DI. Christensen, et.al (2015), the most cited research on DI, pointed to the genesis of DI as the overlooking of low-end or new markets by incumbents who tend to focus their attention on their most profitable customers, which is an entrenched management dogma of staying close to your customer. Tapping into this overlooked segment of customers and the importance of getting the business model right to catalyze the intended disruption is stressed within this article.

The question of what makes an innovation disruptive has been an ongoing focus of previous studies and is explored in depth in *The Innovator’s Manifesto* (Raynor, 2011). Raynor suggests that innovations become disruptive when technological or business model advantages exist within a firm that could be scaled upmarket in a way that allows the firm to maintain its competitive advantage, a concept referred to as the extendable core. Criticisms of the theory of DI, though few and serious (Lepore, 2014), have targeted the conflation approach adopted by Christensen and co-authors where all types of DI come under the broad umbrella of DI (Gobbles 2016; Lepore 2014) regardless of whether the innovations are technological or business model disruptions (Markides, 2006). A few problematic assumptions and inconsistencies in Christensen’s DI theory have provided opportunities for the theory to be tested. The relevance of Raynor’s framework is observed in the 2021 C-suite Challenge Report, which indicated that CEOs are extremely focused on improving innovation and modifying their business model, listed as two of five top priority areas by CEOs. The lack of an innovation culture was highlighted as one of the foreseeable internal obstacles that need to be addressed.

## **Business Schools and Their Role in Innovation**

Aside from remaining competitive, a cutting-edge curriculum must be a staple of B-schools in order to be responsive to the changing needs of the business world and adequately prepare a cadre of graduates capable of performing at the highest level required to impact their field. Similar to firms across myriad industries, for B-schools, “innovation is the only insurance against irrelevance” (Hamel & LaBarre, 2012, para 1). In today’s highly dynamic job environment characterized as Industry 4.0 (Industrial Revolution 4.0), the magnitude and frequency of disruptive innovations is much greater than the early 20<sup>th</sup> century. However, some institutions of higher education still embrace antediluvian skills and knowledge training practices upon which they were founded many decades or centuries ago (Zeidan & Bishnoi, 2020). Clearly, a gap exists between what industry needs, as it relates to the knowledge and skills required from graduates, and what the curriculum offers in higher education (McGuinness & Ortiz, 2016; Rhinehart, 2022).

One of the ways to identify an innovative B-school is to examine the kinds of scholarship produced by faculty (US News and Report, March 2022) to determine whether the intellectual contributions made by faculty are being recognized and utilized by industry leaders as solutions to problems faced. Carr (2005) advanced the concept of high end and top-down disruptions, which runs counter to the central tenets of DI theory (Christensen et al., 2015). It is possible, according to Christensen, that future research could lead to the development of new theories of DI that would account for Carr’s conception. B-schools play an important role in aligning business education with industry business practices; industry and the academy have been compelled to work together to offer real world solutions to challenges faced by both entities and create some alignment between industry needs and academe outputs. The AACSB Task force on Business Schools and Innovation (2009, pp.30-33) offers three recommendations to B-schools for elevating the role of innovation and finding ways that management education can make a greater impact: (1) *using our conceptual framework as a guide, individual business schools should develop and regular evaluate their contributions to innovation in society*; (2) *individual business schools should develop an approach for creating value at the intersection of different perspectives*; (3) *individual business schools should advocate for their role in innovation*.

## **METHODOLOGY**

Using Bibliometric analysis, this study examined a dataset of articles indexed in the Social Science Citation Index (SSCI). Bibliometric analysis, a legitimate quantitative approach to evaluating the progress and maturity of a research field (Garfield, 1955), has emerged as popular tool used by researchers across many disciplines in their efforts to map

the evolution of scholarship in the field or on a given subject, or examine the theoretical, conceptual, and intellectual structure of the field.

### Data Collection

The SSCI database published by Clarivate is used in this study to collect bibliographic content on the disruptive innovation literature including publication and citation data. The SSCI database currently consists of data from over 3,500 trustworthy journals across 47 disciplines with access to broad citation and bibliographic data. Using this index, the search term “disruptive innovation” was used to generate data. A topic search, which searches the title, abstract, author keywords, and keywords on a selected topic, formed the initial scope of the search on “disruptive innovation”, the principal focus of this study. Five publication types were extracted from the Clarivate SSCI database for analysis: articles, review articles, book reviews, editorials, and book chapters. Proceedings papers were excluded from this analysis. All papers were published in English. The period, 2011 to the end of 2022, spanned the collection of publication and citation data. Once the initial search was executed, two other parameters (management or business, and region-USA) were introduced, thereby limiting the scope of the search to articles on disruptive innovation published in the management or business discipline by faculty affiliated with B-schools in the USA. The dataset was then extracted from SSCI to a plain text file.

### Data Analysis

A manual count of the publication and citation data was first done as is standard in bibliometric analyses. The authors individually performed the manual count for reliability purposes and included a second rater to achieve a minimum interrater agreement of 70%. The unit of analysis was the journal publication on disruptive innovation that formed the sample. The plain text file of the dataset was then imported into the R Studio Biblioshiny package (Aria and Cuccurullo, 2017) for analysis. The study was divided into three subperiods: 2011-2014, 2015-2018, and 2019-2022.

## RESULTS

The search for disruptive innovation research in the management discipline, based on this study from 2011 to 2022, yielded only 75 articles published in 42 journals. These 75 articles were cited 3601 times and referenced in 4,452 articles. Out of these 75 published articles, less than three percent (2/75) used a Bibliometric approach.

### Most Relevant Sources and Authors

Of the 75 articles, 8 were published in the Journal of Engineering and Technology Management, 6 articles were published in Journal of Product Innovation Management, 6 articles were published in Research Technology Management, 5 articles were published in Journal of Management Studies and 5 articles were published in Technology Forecasting and Social Change. Table 1.0 shows the top 5 ranked most relevant authority for disseminating disruptive innovation research in the management discipline. Almost 39% of the articles on disruptive innovation were published in 12% of the journals, regarded as the most relevant sources, disseminating disruptive innovation research during this study period. The remaining 61% of the articles were distributed across the remaining 88% of journals. Twelve authors were identified as the most relevant authors based on the bibliographic and citation analysis, with each publishing two articles on disruptive innovation that were widely cited.

Table 1.0 Most Relevant Sources

<i>Sources</i>	<i># of Disruptive Innovation Articles</i>
<i>Journal of Engineering and Technology Management</i>	8
<i>Journal of Product Innovation Management</i>	6
<i>Research Technology Management</i>	6
<i>Journal of Management Studies</i>	5
<i>Technological Forecasting and Social Change</i>	5

### Most Frequently Used Words

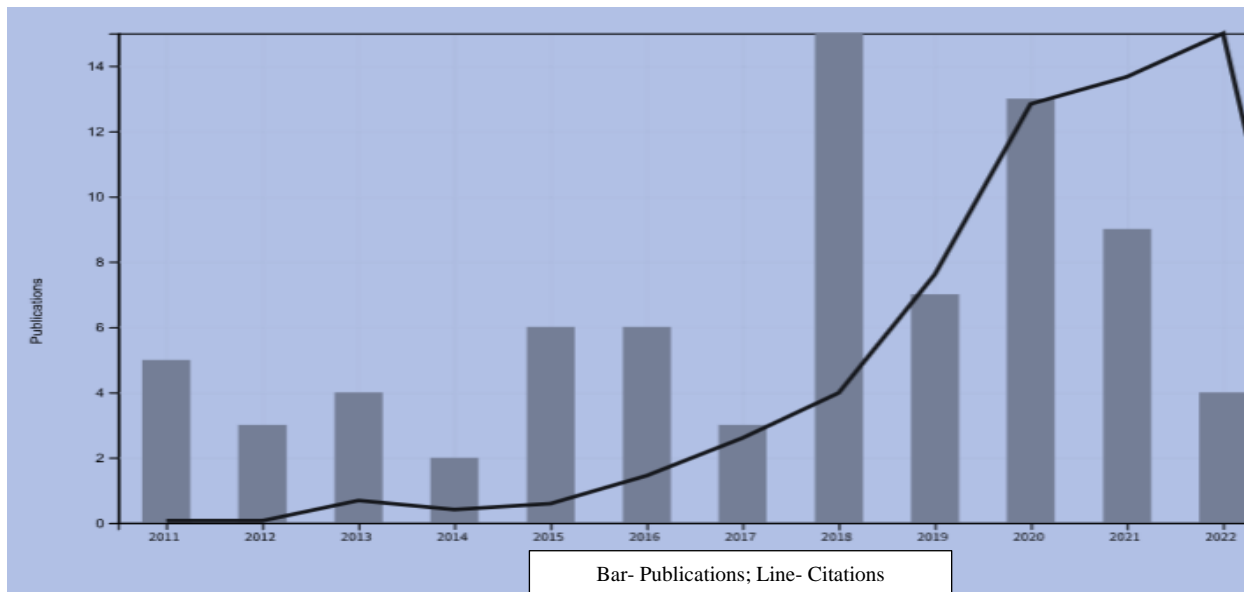
From the 75 papers published across 42 outlets, we identified the 272 most frequently used words found within these papers. The top words frequently used were performance (17 times), disruptive innovation (12 times), entrepreneurship (12 times) capabilities (10 times), industry (9 times), innovation (9 times) and technological discontinuities (9 times). These 7 words form the dominant keywords within disruptive innovation research. The word cloud in figure 1.0 provides a visualization of the relative significance of research topics associated with disruptive innovation.

Figure 1.0. Word Cloud



Figure 2.0 shows trends in the number of publications and citations for disruptive innovation scholarship. From 2011-2014, there were 559 citations and 14 published articles. From 2015-2018, there were 2,679 citations and 30 published articles. The final time period analyzed within this study, 2019-2022, had the least citations with 475 citations and 33 published articles. The most active period for disruptive innovation research was 2015-2018, which represented a 379% increase in citations and 114% increase in the number of articles published. In each period, there was an increase in the number of articles published on disruptive innovation.

Figure 2.0. Performance of Disruptive Innovation Research: Times Cited and Publications Over Time



The thematic map in figure 3.0 provides an unsliced view of the centrality and density of themes identified in the disruptive innovation research across the entire period, 2011-2022. The foundational themes, found in the motor themes quadrant, are also featured prominently in the word cloud in figure 1. The motor themes quadrant identifies seminal themes that are crucial pillars to support the structure of the field, these themes are also well developed. The second quadrant, *basic themes*, are essentially themes that are widely known and highly developed, but these themes have over time become isolated or regarded as having limited significance in the field. The third quadrant, *emerging or declining themes*, convey themes in the field that are still in the inchoate state and on the peripheral of the field. The fourth quadrant, *niche themes*, identifies themes that are global and transversal and could be applied to several research areas in and out of the field.



**Figure 3.0. Thematic Map, 2011-2022**

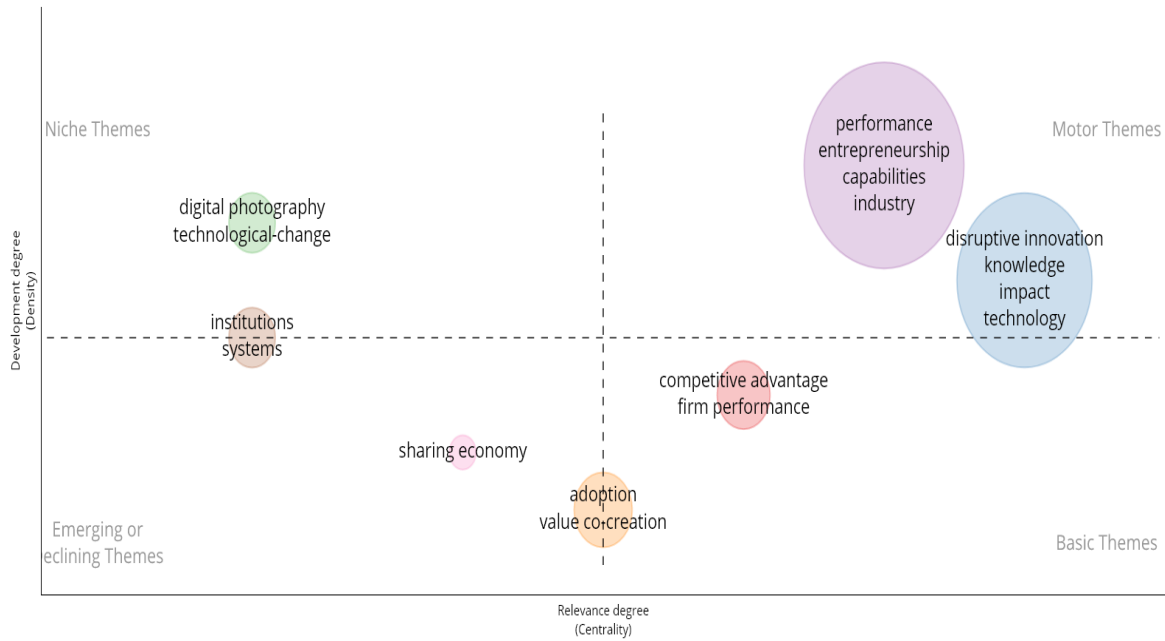


Table 2.0 shows the thematic evolution of the research on disruptive innovation from 2011-2022, by spotlighting different time periods. A general shift in focus is observed across the various from one time period to the next. The most dominant period for disruptive innovation appears to be 2015-2018, with myriad themes rising to either centrality or density across each of the four quadrants.

**Table 2.0. Thematic Evolution of Disruptive Innovation Research**

Time Period/Quadrants	2011-2014	2015-2018	2019-2022
Quadrant 1- Motor Themes	Market orientation, Performance, Emergence	Technological discontinuities, Capabilities, Model, Performance, Entrepreneurship, Innovation	Capabilities, Firm, Absorptive Capacity, Disruptive Innovation, Performance, Entrepreneurship
Quadrant 2- Basic Themes	Capabilities	Technology, Dynamic Capabilities, Creative Destruction	Impact, Knowledge, Business
Quadrant 3- Emerging or Declining Themes	Product Innovation	Radical Innovation, Competitive Advantage, Disruptive Innovation	Model, Product Development, Technological Change
Quadrant 4- Niche Themes	Firms, Entrepreneurship, Market	Absorption, Diffusion, Network,	Innovation, Firms, Information

**Influential Publications**

Of the top 10 most cited publications (refer to Table 3.0), only one was published in the first time period, 2011-2014, 8 were published in the second time period, 2015-18, and one was published in the 2019-2022 period. The 2015 thru 2018 period represented the strongest period of research leading to the publication of the most influential research on disruptive innovation. The most influential work on disruptive innovation, Christensen (2015), was cited 568 times.

**Table 3.0. Most Cited Publications**

Article Title	Journal	Pub Year	Total Cites	TC per Year
The Big Idea. What is Disruptive Innovation	Harvard Business Review	2015	568	63.11
Motivations and constraints of Airbnb consumers: Findings from a mixed-methods approach	Tourism Management	2018	245	40.83
The role of dynamic capabilities in responding to digital disruption: A factor-based study of the newspaper industry.	Journal of Management Information System	2015	242	26.89
The disruptor's dilemma: TiVo and the US television ecosystem.	Strategic Management Journal	2016	212	26.50
Disruptive innovation: An intellectual history and directions for future research	Journal of Management Studies	2018	175	29.50
Explorative versus exploitative business model change: the cognitive antecedents of firm-level responses to disruptive innovation	Strategic Entrepreneurship Journal	2015	140	15.56
Reverse innovation, emerging markets, and global strategy	Journal of Product Innovation Management	2011	112	8.62
How useful is the theory of disruptive innovation?	MIT Sloan Management	2015	107	11.89
Defining and identifying disruptive innovations	Industrial Market Management	2016	105	13.13
Adding evidence to the debate: Quantifying Airbnb's disruptive impact on ten key hotel markets	Tourism Management	2019	102	20.40

## DISCUSSION AND CONCLUSION

Not many academic management theories have had a profound impact on the world of business as Christensen's theory of disruptive innovation. Understanding the evolution of the disruptive innovation field from 2011 to 2022, after further refining of the theory by Christensen in 2003 and 2006, provides a depth of understanding of the current state of research on the subject and future directions along with implications for B-schools. Bibliometric analysis, a useful tool for conducting a quantitative study of the intellectual contributions of scholars allowing for a more systematic way of understanding a field of study, has been featured less compared to other research methods (Castillo-Vergara et. al., 2018). Of 75 published articles on disruptive innovation analyzed for this study, less than three percent (2/75) used a Bibliometric approach. The results of the study outlined the most influential publications, citation analysis, research trends in different subperiods from 2011-2022, and importantly the conceptual structure of the field.

This study found that the number of publications on disruptive innovation increased from 2011 to 2022. The research on disruptive innovation in the management discipline has matured significantly during this time and has been well explored since the theory of disruptive innovation was first developed in 1995, thereby leaving fewer management areas under researched from a disruptive innovation perspective. Evidence within this study indicated that the impact of disruptive innovation research in the management field has increased. The citation analysis done in this study revealed that over 77% of the published articles on disruptive innovation have been cited more than once, which compares favorably to the 42% of published papers in over 4500 top scientific journals that received more than one citation (Thompson Reuters, 2002). On the other hand, 15% of the articles in this dataset were cited only once and approximately 10% of the articles were never cited. The percentage for non-citation of published work on disruptive innovation field is far lower than the 25% of scientific papers that go uncited, according to Koshy (1976), which is a positive indication of the maturity and growing influence of the body of knowledge in this field.

The thematic evolution of the field, as shown in Table 2.0, shows disruptive innovation research progressing more into the motor themes quadrant, which identifies themes that are well developed and act as critical pillars to the field's structure. However, the kinds of themes featured in quadrant four, which represents global themes, have significant implications when considering the development of B-schools' curriculum around disruptive innovation. For example, in the fourth quadrant of the period 2019-2022, three topics were identified: innovation, firms, and information. Therefore, considering the rise of information as one of the newer and major themes within the broader research of disruptive innovation, opportunities may exist for B-schools to think about ways to incorporate artificial intelligence and Big Data into predicting either the successful disruption of an innovation or predicting the kinds of innovation required to disrupt an industry. One consideration that cannot be ignored is the rise of artificial intelligence across multiple industries and its capabilities of automating simple and complex tasks, with increasing precision as well as speed, which could potentially serve as a major catalyst for disruption. Another implication of the findings from the fourth quadrant is that a paradigm in disruptive innovation is occurring, where the emerging themes are more global, which means that opportunities exist for greater interdisciplinary collaboration and cross pollination of ideas on disruptive innovation. Business schools therefore need to "view emerging trends as clarion calls for us to reinvent

business education” (Kang, 2022, para. 1). From this study, the emerging trends in disruptive innovation research show a clear leaning toward fostering innovations that go beyond the field of management, calling therefore for new ways in which we engage external partners, incorporate emerging and advanced technology, and leverage. Future proofing our business programs, while maintaining cutting edge faculty scholarship, must remain a top priority for business schools that are committed to preparing learners who meet industry needs and anchoring the business ecosystems that we serve.

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# The Water Park Locker Problem – An Interactive Spreadsheet Exercise in an Operations and Analytics class

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## ABSTRACT

An important skill expected of business majors is their ability to use spreadsheets. Our experience has shown that students are enthusiastic when they can relate to the topic and when the spreadsheet is interactive in nature. We present the Amusement/Water Park related locker problem where guests must enter the water park areas in their swimwear. Hence, they rent lockers to store their clothes and valuables. This article is motivated by a recent visit to a water park where we could rent a locker for an entire day. To make the problem worthy of classroom discussion, we choose to include the “return” concept. In other words, there is an incentive for guests when they let the water park staff know before a certain time that they do not need the locker anymore. This enables the staff to keep track of available lockers at all times. When demand for lockers exceeds supply, the problem is similar to the overbooking models of the airlines industry and the hotel industry. Thus, this problem can be used as an example while discussing such overbooking models in a topic called *revenue management*. The students are led by the Professor in a brainstorming session related to an interesting scenario of this locker problem. Finally, the students are guided in building an interactive Excel spreadsheet. The locker problem lends itself to an interesting discussion even in a Computer Science course where the students can be asked to code this problem using Python or another programming language.

**Keywords:** Spreadsheet skills, Revenue Management, management strategy and brainstorming

## INTRODUCTION

Amusement parks provide several attractions, such as rides and games, and other events for the purpose of entertainment, thrill and distractions to customers who wish to take a day off their routine schedules or jobs. Due to weather conditions in various parts of U.S.A., outdoor recreational facilities are seasonal and open only during certain months of the year. During summer, the most popular attractions in amusement parks are waterplay areas such as waterslides, splash pads, spray grounds, lazy rivers or other recreational bathing and swimming environments. These parks may be indoors, outdoors or a combination of both. These parks rent lockers in addition to other add-ons like strollers and wheelchairs. For example, Disney World has separate/different pricing for its available lockers at the theme parks and its water parks (<https://disneyworld.disney.go.com/guest-services/locker-rentals/>). Dorney Park & Wildwater Kingdom, located in Allentown, PA provides pricing for even a season pass locker rental (<https://www.dorneypark.com/rentals>). Similarly, Noah’s Ark Waterpark located in Wisconsin Dells also states on its website that there are kiosks available to purchase lockers and that there is no deposit required (<https://www.noahsarkwaterpark.com/prepare-your-visit/people---services/lockers---rentals>).

## THE LOCKER PROBLEM

Typically, water parks have two locker facilities/areas within their premises: one at the park entrance and one close to water related rides and attractions. These facilities have lockers and changing areas/rooms. For the guests to rent the lockers, there are kiosks available at these facilities. The kiosks also show pictures of the types/sizes of available lockers. A sample kiosk is shown in Figure 1 on the following page.

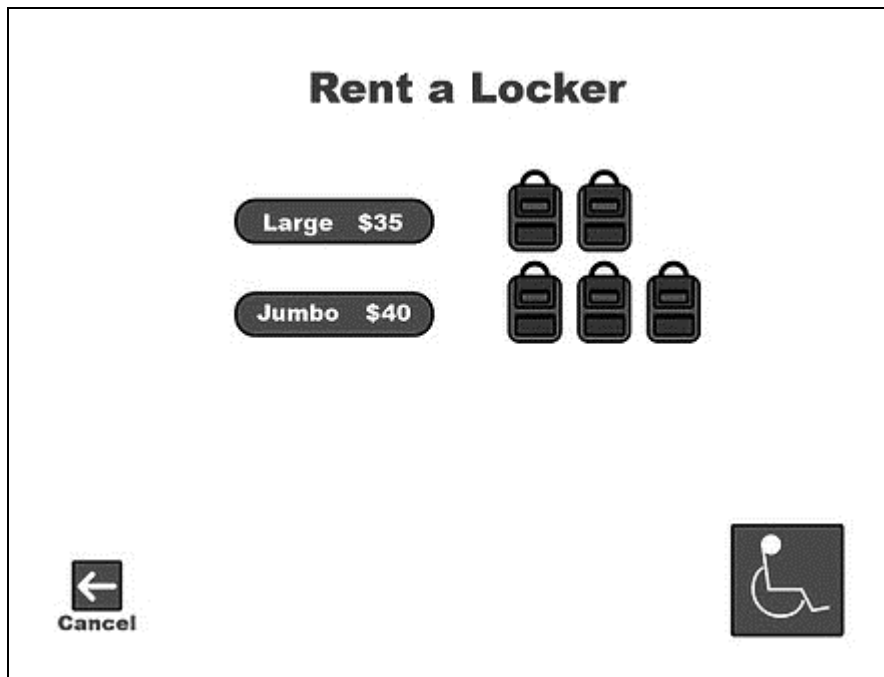
As seen in Figure 1, the park has two locker sizes that the guests could choose from: **Large** and **Jumbo**. The Large locker costs \$35 to rent and has sufficient space to fit two standard sized backpacks. The Jumbo locker costs \$40 to rent and has space to fit three standard backpacks. Upon choosing the size, the guests are prompted to enter a 4-digit code for their locker. The kiosk then assigns a locker number which the guest can open using this 4-digit code and then store clothes and other valuables.

### All day Rental ability

Interestingly, most water parks allow guests to rent their assigned lockers for the entire day. This was the primary motivating factor for this article. We wondered why a water park is not concerned about demand exceeding supply. Several water parks also employ a marketing strategy of charging *only half the normal ticket price* for guests entering the park after 3 pm. This strategy brings more guests into the park. When the weather is very

warm, the afternoon guests are likely to entertain themselves with water-related activities as soon as they enter the park and that results in an immediate demand for available lockers. Since we were able to rent a locker for the entire day, we assume that water parks may have installed far too many lockers and may never run out of lockers to rent. Lockers are typically installed during the construction phase of such parks. Water parks may use simple “rules of thumb” to decide on the number of lockers to be made available for guests. A possible rule of thumb may be to ensure that the number of rental lockers is at least twice the number of parking spots. In other words, if there are 1000 parking spots available at a water park and if guests from every car/automobile rent two lockers, then the water park may decide to have 2000 lockers installed. This strategy may ensure that the park never runs out of lockers. We also assume that guests do not park their cars elsewhere.

**Figure 1**



### INCORPORATING THE “RETURN” CONCEPT

We have all experienced waiting for empty carts at a grocery store on the day before an impending snowstorm – an example where the number of shoppers exceeds the number of shopping carts. We have also experienced waiting for a shopping cart at retail outlets on Black Friday. It is very realistic to assume that one of the two locker areas/facilities at a water park may require unexpected repairs during the summer months. This scenario may result in demand exceeding supply since half of the total number of lockers are temporarily unavailable. Hence, we make this Locker Problem more interesting by incorporating the “return” concept into our discussion.

Automated kiosks at water parks are a relatively new feature. In the case of the older system that was in place a few years back, the guest would go to an assigned window and request for a locker to rent. The guest would be given a key that used to be tied to a wristband so that it stays with the guest even in water. However, the guest was required to pay about \$25 *in addition* to the locker rental fee. This \$25 was like a deposit which would be returned to the guest upon returning the locker key before leaving the park. The rationale behind this \$25 deposit was that the park would have to spend money to make another key for that locker if the guest leaves without returning the key. Also, if the deposit amount is as high as \$25, the guest is more likely to return the key before leaving the park. And this system also enabled the staff to have an exact count of available lockers at any time.

In the case of the new automated system with kiosks, there is no deposit or additional fee charged. The morning guests may choose to use the locker all day or may leave the park well before closing time. However, since there is no deposit charged to the guest, the water park staff may have no knowledge of when a guest has left the park. Thus, the staff is unaware of the fact that this locker is now available to rent again that same day.

### **Unforeseen repair/maintenance of a locker facility**

As stated earlier, if a water park has two locker facilities and if one of its facilities requires unexpected repair, then the number of available lockers to rent will be reduced to about 50% of its original capacity. This may result in *demand exceeding supply*. This in turn may result in wait times for the afternoon guests to rent a locker. The water park management would have to rethink the entire process. Even if the repairs are only for a few days, management cannot afford to lose its business or have too many dissatisfied customers. This scenario has proven to be an excellent classroom discussion especially in an operations research classroom while discussing the topic, “*revenue management*” and related overbooking models.

### **Revenue Management and overbooking models**

We provide a brief introduction to two important overbooking models and explain how the locker problem is similar and yet different from these models. The well known and well-studied overbooking model is that of the overbooking of passenger seats (Talluri and Ryzin, 2004) in the airline industry. Its impact on the financial success of airlines is well documented (Smith, Leimkuhler, and Darrow, 1992). Some researchers use a discrete Markov decision process model (Subramanian, Stidham, and Lautenbacher, 1999) which considers multiple fare classes and examines customer spill over from one class to another class. For example, economy passengers are spilled over to first class when economy class fills up. Since such a demand is measured in the number of passenger seats, it is one-dimensional. The second important model is the less studied two-dimensional *cargo* overbooking model (Luo, Cakanyildirim, and Kasilingam, 2009). This is two dimensional due to its weight and volume considerations and where the objective is to find the optimal weight and volume overbooking limits.

The instructor can lead this discussion and first explain how the locker related problem is different from the above models. The biggest difference is that the surplus (or overbooked) passengers/cargo cannot go in that flight/ship. In the case of a slightly overbooked flight, economy class passengers are spilled over to first class. Otherwise, the surplus passengers cannot board that flight and airlines typically compensate them by offering them the next flight within a few hours and a travel voucher valid for one year. In the case of our locker problem, the guests may only have to wait for some time to gain access to available lockers – like customers waiting for shopping carts at a grocery store or a retail store. Also, the guests at the water park may be requested to entertain themselves for some time with activities that are not water related. Additionally, the water park management may be able to compensate by offering some incentives. With this introduction and brief explanation, the students are now encouraged to brainstorm and provide some feasible solutions.

### **Brainstorming in the classroom**

Students participate enthusiastically during this brainstorming session and present several viable and feasible solutions that may minimize the frustration of these afternoon guests while waiting for available lockers.

- (i) Extend closing time of water-related attractions. In other words, management may decide to delay the closing time perhaps by 30 minutes - if all safety standards and protocols are met.
- (ii) Engage the afternoon guests for some time by providing seating and offering 50% discount at the adjacent ice cream store while they are waiting for available lockers.
- (iii) If the afternoon guests wait for more than 30 minutes, then give free afternoon tickets for another day – a strategy used by airlines when flights are delayed or canceled.
- (iv) Temporarily suspend the marketing strategy of 50% discount for afternoon guests. This will reduce afternoon guests and minimize the possibility of demand exceeding supply in the case of lockers.
- (v) Suppose the park is out of Large lockers and only Jumbo lockers are available. Then the staff could rent Jumbo lockers to guests for the lower rental price of a Large locker – a strategy that will appeal to the guests. This is like the airlines moving some economy class passengers into first-class seating.
- (vi) Encourage morning guests to “return” their lockers before 3 pm by providing incentives such as free afternoon tickets for another day. For guests who need instant gratification, a 50% refund on their locker rental fee or on their parking fee may seem appealing. To avail such incentives, guests must go to a nearby counter. Since guests must physically go to a counter, the staff would then have real-time information about all returned lockers that can be rented again that afternoon.

Most of the above suggestions are arguably feasible. However, some are only strategies to buy some time for the lockers to become available. The guests will be satisfied only when they are able to rent lockers. Hence, we look into the idea of “returning” the lockers by the morning guests. In the next section, we provide an outline of our

proposed interactive spreadsheet that will focus on renting lockers, returning lockers and the proposed incentives for morning guests to return lockers by 3 PM that afternoon.

## DEVELOPING THE EXCEL SPREADSHEET

Here, we provide an overview of the proposed Excel spreadsheet using the idea of “returning” the locker by the morning guest. The goal of the water park management is to have lockers available for any guest who wants to rent them. Because of current repairs, there is bound to be a scarcity of lockers at the park. So, the management must offer some incentives for the morning guest to return the locker by 3 PM. The incentive must be so good that several morning guests will take up on it and return the locker by that time. Returning the locker essentially means that the guests notify the staff that they no longer need the locker and that it could be rented to other guests. For this, the guest must go to a counter and then receive the incentive promised by the staff.

The students create this spreadsheet from scratch. We assume only two locker sizes: Large & Jumbo. And we assume there are only 3 lockers in each size. If the guest chooses to rent a Large locker, a message saying the fee is \$35 is displayed. Upon “returning” the locker on time, a message saying the guest will get a refund may be displayed. For another guest, a message like, “*Surprise Gift*” may pop up. For a guest who returns the locker around closing time, the message, “*Thank you. Please visit us again*” may be displayed indicating that this guest will not receive an incentive. Also, when all Large lockers are rented, the message “*Sorry, Out of Large lockers*” is displayed. The proposed spreadsheet must have similar features in the case of Jumbo lockers too.

A detailed set of instructions to create this interactive spreadsheet is provided in Appendix A. And Appendix B has some screen shots of how the spreadsheet looks: (i) before renting any of the lockers, (ii) during the rental process where only some lockers are rented, and (iii) when all lockers are rented.

## CONCLUDING REMARKS

We discussed the Water park locker problem in this paper. This is an original problem and we discussed how management may solve this real-life problem of *demand exceeding supply*. This happens in the airline industry on a daily basis due to overbooking of flights. This is an interesting case and students learn concepts of revenue management and overbooking models such as passenger overbooking in airlines, guest overbooking in hotels, and cargo overbooking. The students also participate in a brainstorming session to identify feasible solutions in the case of the locker problem. Finally, the students create a spreadsheet from scratch for this locker problem and improve their Excel skills in the process. This exercise can be targeted in any class that uses Excel spreadsheets. There are various features of Excel used in this spreadsheet and the students can benefit from this exercise. However, an Operations Management classroom can be an excellent platform since the locker problem lends itself to interesting discussions that support topics like revenue management and overbooking models.

*Note: The spreadsheet used in this exercise is available for instructors from the author by emailing Jaideep.Naidu@Jefferson.edu.*

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## APPENDIX – A

### **Step-by-step instructions and related discussion for the Water Park Locker Spreadsheet Exercise**

Our specific *cell address based instructions* are based on the instructor prepared spreadsheet. So, when a student has a question about a particular cell, it becomes easy to respond and guide the student.

1. Open an Excel spreadsheet and INPUT the following data/text in the following cells of the worksheet.
  - B2: LARGE
  - C2: Locker #
  - C3: Guest #
  - C4: Status
  - C5: FEE
  - C6: REFUND
  - D3: Guest 1
  - E3: Guest 2
  - F3: Guest 3
  - I3: Total
  - I4: Rented
  - I5: Available
  - J2: JUMBO
  - J3: 3
  - K2: LARGE
  - K3: 3
  - J7: Data Labels
  - J8: Rented
  - J9: Available
  - J10: Return
  - K7: Locker Size
  - K8: Large
  - K9: Jumbo
  - L7: Start
  - L8: 100
  - L9: 200

*Note:* Since the above is essentially data entry/typing, the Professor may eliminate making the students type the above data/text. Instead, an Excel file can be emailed to students (with the above already entered). This also saves a few minutes in the classroom.

2. Cells D4, E4, and F4 must have the following in their dropdown menu: *Rented, Available, Return*. To be able to do this in cell D4, put the cursor in that cell, click “Data”, click “Data Validation”, select “List” and select “J8:J10”. This is a brief set of instructions. If needed, we provide a more detailed set of instructions to our students. D4 can then simply be copied and pasted on to cells E4 and F4.
3. The students will now start entering Excel formulas in various other cells of this spreadsheet. To make it convenient for the student, we provide a hard copy of Figure 2 since it has the cell address of various cells where Excel formulas must be entered. We write the Excel formulas in a logical sequence and explain the formulas as we create this spreadsheet.

Our first set of formulas will be for cells K4 and K5. Cell K4 must show the number of lockers that are currently rented. This is based on the cells D4, E4, and F4. And cell K5 must show available lockers. Once the students enter these formulas, they are asked to play around with the dropdown menu in cells D4, E4, and F4. It is then that both formulas in K4 and K5 would begin to make sense.

- K4: =COUNTIF(D4:F4,J8)
- K5: =K3-K4



**Figure 2**

<b>LARGE</b>	Locker #	D2	E2	F2	<b>G2</b>		<b>JUMBO</b>	<b>LARGE</b>
	Guest #	Guest 1	Guest 2	Guest 3		Total	3	3
	Status	Available	Available	Available		Rented	J4	K4
	FEE	D5	E5	F5		Available	J5	K5
	REFUND	D6	E6	F6				

Data Labels	Locker Size	Start
Rented	Large	100
Available	Jumbo	200
Return		

<b>JUMBO</b>	Locker #	D10	E10	F10	<b>G10</b>
	Guest #	Guest 4	Guest 5	Guest 6	
	Status	Available	Available	Available	
	FEE	D13	E13	F13	
	REFUND	D14	E14	F14	

The next set of formulas are for cells D2, E2, and F2. These essentially generate the locker numbers with the starting value being 100 for Guest 1, 101 for Guest 2 and 102 for Guest 3. The formula in cell D2 may require explanation and then the Excel formulas for E2 and F2 become obvious.

- D2: =IF(D4=\$J\$8, \$L\$8\*(K\$3-2), "")
- E2: =IF(E4=\$J\$8, \$L\$8\*(K\$3-2)+1, "")
- F2: =IF(F4=\$J\$8, \$L\$8\*(K\$3-2)+2, "")

The next set of formulas are for cells D5, E5, and F5. These essentially show the rental fee information for the lockers and is displayed when a guest rents a locker.

- D5: =IF(D4=\$J\$8, "Locker fee is \$35", "")
- E5: =IF(E4=\$J\$8, "Locker fee is \$35", "")
- F5: =IF(F4=\$J\$8, "Locker fee is \$35", "")

The next set of formulas are for cells D6, E6, and F6. These cells display the incentive (or no incentive) provided by management. When a guest returns a locker before a specified time, the locker rental refund may be \$25. The management may also choose to give a surprise gift such as a free afternoon ticket valid for a year. If the guest returns the locker after the specified time, then there may be no incentive and a message such as, "Thank you. Please visit us again" may be displayed.

- D6: =IF(D4=\$J\$10, "Refund is \$25", "")
- E6: =IF(E4=\$J\$10, "Surprise Gift", "")
- F6: =IF(F4=\$J\$10, "Thank you. Please visit us again", "")

Lastly, the following formula is for cell G2. If the number of Available Large lockers is Zero, then a message such as, "Sorry, out of Large Lockers" will be displayed.

- G2: =IF(K5=0, "SORRY, OUT OF LARGE LOCKERS", "")

Note that the above set of spreadsheet instructions are to rent and return Large lockers. Since Figure 2 includes Jumbo lockers too, we ask the students to complete that portion of the spreadsheet.

**APPENDIX – B**

This section has screen shots of how the spreadsheets looks: (i) before renting any of the lockers, (ii) during the rental process where only some lockers are rented, and (iii) when all lockers are rented.

**Figure 3: A screenshot before renting any of the lockers**

<b>LARGE</b>	Locker #					<table border="1"> <tr> <td></td> <td><b>JUMBO</b></td> <td><b>LARGE</b></td> </tr> <tr> <td>Total</td> <td>3</td> <td>3</td> </tr> <tr> <td>Rented</td> <td>0</td> <td>0</td> </tr> <tr> <td>Available</td> <td>3</td> <td>3</td> </tr> </table>		<b>JUMBO</b>	<b>LARGE</b>	Total	3	3	Rented	0	0	Available	3	3
		<b>JUMBO</b>	<b>LARGE</b>															
	Total	3	3															
	Rented	0	0															
	Available	3	3															
Guest #	Guest 1	Guest 2	Guest 3															
Status	Available	Available	Available															
FEE																		
REFUND					<table border="1"> <tr> <td>Data Labels</td> <td>Locker Size</td> <td>Start</td> </tr> <tr> <td>Rented</td> <td>Large</td> <td>100</td> </tr> <tr> <td>Available</td> <td>Jumbo</td> <td>200</td> </tr> <tr> <td>Return</td> <td></td> <td></td> </tr> </table>	Data Labels	Locker Size	Start	Rented	Large	100	Available	Jumbo	200	Return			
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	Total	3	3															
	Rented	1	1															
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Rented	Large	100																
Available	Jumbo	200																
Return																		

**Figure 4: A screenshot of some lockers being rented, some are returned and some still available**

<b>LARGE</b>	Locker #	100				<table border="1"> <tr> <td></td> <td><b>JUMBO</b></td> <td><b>LARGE</b></td> </tr> <tr> <td>Total</td> <td>3</td> <td>3</td> </tr> <tr> <td>Rented</td> <td>1</td> <td>1</td> </tr> <tr> <td>Available</td> <td>2</td> <td>2</td> </tr> </table>		<b>JUMBO</b>	<b>LARGE</b>	Total	3	3	Rented	1	1	Available	2	2
		<b>JUMBO</b>	<b>LARGE</b>															
	Total	3	3															
	Rented	1	1															
	Available	2	2															
Guest #	Guest 1	Guest 2	Guest 3															
Status	Rented	Return	Return															
FEE	Locker fee is \$35																	
REFUND		Surprise Gift	Thank you. Please visit us again.		<table border="1"> <tr> <td>Data Labels</td> <td>Locker Size</td> <td>Start</td> </tr> <tr> <td>Rented</td> <td>Large</td> <td>100</td> </tr> <tr> <td>Available</td> <td>Jumbo</td> <td>200</td> </tr> <tr> <td>Return</td> <td></td> <td></td> </tr> </table>	Data Labels	Locker Size	Start	Rented	Large	100	Available	Jumbo	200	Return			
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**Figure 5: A screenshot when all lockers are rented**

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# One Bridge, Two Gaps: The Unrealized Interprofessional Potential for Law and Accounting Clinical Collaboration

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## ABSTRACT

Law Schools offer many experiential learning programs to law students. Law school experiential learning tends to be siloed, involving only law students, and does not cross disciplines to facilitate interprofessional education. Experiential learning involving both law and accounting students will benefit them throughout their careers as they will work together on teams to serve clients. Law students can participate in Low-Income Taxpayer Clinics (“LITC”), where students represent clients in tax disputes with the IRS. Accounting students can participate in Volunteer Income Tax Assistance (“VITA”) programs, preparing tax returns and helping clients with tax compliance. Once law and accounting students start to practice, tax compliance and tax representation are intertwined and are not siloed between law and accounting. To help students experience this interdisciplinary relationship, law schools and accounting programs need to create experiential learning opportunities where law and accounting students work together. Cornell University has developed a program to help facilitate interprofessional learning between law and accounting students.

**Keywords:** Interprofessional learning, Law, Accounting, Tax, Clinical education, VITA

## INTRODUCTION

The accountancy and legal professions are as intertwined as they are influential, collaborating to manage nearly every aspect of American business and public life. However, their education does not prepare them for the collaborative aspect of this shared responsibility. Although they will work in teams throughout their careers to serve mutual clients, accounting students and law students are trained in isolation, sometimes sitting in tax law classes together, but rarely, if ever, working together in experiential training. It has long been recognized that the scholarship of accounting and law needs to become more interdisciplinary, and there is enormous scope for such interprofessional training (Freeman & Power, 1991). Meanwhile, there is an enormous need for students of both fields to contribute their time and talents to assist low-income taxpayers. There is a large gap in IRS-funded services for low-income taxpayers in support of past-due tax return preparation. Interprofessional tax return preparation services for low-income taxpayers can bridge both gaps. Although some accounting students engage in community-based Volunteer Income Tax Assistance (“VITA”) sites, the students typically participate as volunteers in an extracurricular activity rather than through an experiential curricular offering. Those accounting schools that have included VITA-based courses as part of their curriculum have not been as extensive as the clinical legal offerings.

Meanwhile, many law schools provide free representation to low-income taxpayers through the IRS-subsidized network of for-credit Low-Income Taxpayer Clinics (“LITC”) (Johnson & Grossman, 2000). The number of LITC’s have grown significantly since the passage of the Revenue Reform Act of 1998, which created I.R.C. § 7526 (Fogg, 2013). I.R.C. § 7526 grants tax clinics up to \$100,000 a year. Prior to I.R.C. § 7526, only 16 LITC’s existed whereas today there are over 130 clinics (Stewart, 2022; Fogg, 2013). Virtually all this important work occurs within disciplinary silos and does not capitalize on the valuable interprofessional potential of co-training accounting and law students (Hannigan & Afterman, 1971). Interprofessional programs might also provide a necessary bridge between controversy and compliance work seen respectively in law and in accounting. Thus, an interprofessional course offering will expose accounting students to controversy work, under the supervision of a lawyer, and law students to compliance, under the supervision of a Certified Public Accountant (CPA) or Enrolled Agent (EA). Even though lawyers may not often prepare tax returns in practice, it is important that they understand the inner workings of returns.

## PART 1: GOALS

In 2017-2018, after a needs-assessment involving consultation with community stakeholders and national experts, the Cornell SC Johnson College of Business and Law School launched a pilot interprofessional curriculum to provide accounting and law tax services to low-income immigrants both locally and nationally. The pilot curriculum included a fall College of Business simulation-based course prerequisite serving , entitled Federal Income Taxation of Low-Income Taxpayers, and a live-client experiential spring Law School course entitled Low-Income Taxpayer Law and Accounting Practicum. A mix of accounting and law students participated in both courses.

Over the course of the spring semester, six students from the fall course enrolled in the Law School-based Practicum. The Practicum included a one-credit simulation-based classroom component, and an additional credit awarded for a minimum of forty-two and a half hours of casework over the course of the semester. The seminar portion of the Practicum covered three main areas: skills topics such as interviewing, counseling, and working with interpreters; substantive topics such as taxation of low-wage “H2A” agricultural guest workers and exonerees and comparative (law- and accounting-) interprofessional ethics rules; and case rounds. Adjunct faculty-supervisors, in both accounting and law, with specific expertise in providing services to low-income taxpayers co-taught the seminar portion of the course along with three of the authors. The students were assigned three types of work: 1) past due returns and other complex matters working with low-income immigrants (most of them farmworkers) and exonerees; 2) work at various VITA sites, primarily in locations near campus and also through the ABDC program in Alaska; and 3) policy research for community partners.

**Building Interprofessional Skills.** Assisting low-income taxpayers allows both law students and accounting students to grapple with a host of unique issues. Involving accounting students in tax compliance for low-income individuals provides students with invaluable lessons about U.S. Federal, state, and local tax laws, including the tax forms and terminology they will not see, or hear about, in the classroom. For the Cornell students who work with immigrants, exonerees, Alaskan villagers, and residents of upstate New York, their work requires that they learn the interaction of tax law with other policies affecting particular communities. Students working with low-income individuals learn valuable lessons about cross-cultural professional services. Students can help taxpayers to manage their fear of the government, acting as a bridge to the tax system.

Colleges and universities are working to break down departmental silos across their campuses, by encouraging interdisciplinary collaboration. However, legal education (including clinical legal education) has not been quick to embrace this approach (Mehrotra, 2005; Gouvin et al., 2011). Pre-professional silos do a disservice to students whose careers will likely depend on their ability to work effectively in teams.

In a survey conducted by the authors, we asked law school clinical faculty whether they have an interdisciplinary program in conjunction with their college/university’s accounting department. Out of forty-three respondents who completed the survey, only three, including Cornell’s Low-Income Taxpayer Law and Accounting Practicum, Nova Southeastern University’s Berger Entrepreneur Clinic and Civil Field Placement Clinic, and Pace’s Investor Rights Clinic (7% of all respondents), said they had such a relationship with their colleagues in accounting.

Owing to the ubiquitous nature of taxation, accountants are uniquely required to collaborate with other professions, in particular lawyers. Working with low-income taxpayers affords invaluable opportunities for accounting students and faculty within the accounting program, to engage in interprofessional training with future lawyers, as well as other disciplines across campus. Interprofessional programs offer future accountants and CPAs the opportunity to encounter other future professionals in a setting encouraging them to engage in role exploration and definition, better equipping them to work across disciplinary lines for the rest of their careers.

Although they have cross-certification to work on tax matters, accountants and lawyers have their own freestanding ethical obligations. Each profession’s code of conduct does hold accountants and lawyers to a higher standard of care due to the service component of each of their professions. Therefore, when collaborating on projects, it is important that both accountants and lawyers understand one another’s roles, expectations, and codes of conducts. Additionally, both accountants and lawyers must abide by the ethics and standards set by Circular 230 when practicing in front of

the IRS. So, not only do they have their own set of ethical obligations but also share a set too, further emphasizing how intertwined the two professions are.

Within the context of providing services to low-income immigrant taxpayers, accounting and law students can collaborate in several important ways. Law students can be trained to provide tax accounting services for clients, working alongside accounting students and supervisors to conduct “forensic” tax accounting and tax compliance services. Accounting students can learn legal ethics for a better future understanding of the dedication to zealous advocacy they will encounter in the lawyers they work with in the future.

**Community Need.** The IRS funding flows into four general endeavors: 1) advice and online tools provided directly by the IRS; 2) Volunteer Income Tax Assistance (VITA), enabling supporting community agencies to provide tax return preparation assistance; 3) Tax Counseling for the Elderly (TCE), providing VITA-type work to elders; and 4) funding for a national network of Low-Income Taxpayer Clinics (LITC) charged with providing legal representation to individuals embroiled in a controversy with the IRS. These government-funded services focus on tax controversy representation before the tax court, informational outreach, and tax-season-only preparation. Across these initiatives, the least successfully addressed need is assistance with past-due tax returns. Although the LITC mandate to handle controversies technically covers past due returns, LITCs overwhelmingly handle collection matters and Tax Court cases and do not routinely take on past due returns outside the context of necessary compliance to resolve an active controversy. Meanwhile, while VITA sites offer free tax return preparation for the current year during the months from January through mid-April, and similarly have a mandate that covers past due returns, those sites frequently provide no assistance if the taxpayer needs help outside the filing season (*Free Tax*, n.d.). LITCs and VITA have primary roles that engage particular areas of expertise, and there is insufficient collaboration to overcome the gap. For conceptual clarity, the figure at Appendix One diagrams the provision of major tax services by IRS grantee organizations, reflecting the actual grantee priorities rather than technical government mandates.

## **PART II: CORNELL LOW INCOME TAXPAYER PROGRAM**

**Federal Income Taxation of Low-Income Taxpayers.** In the fall semester, students, in a cross-listed law/accounting course, studied low-income taxpayer policy issues, prepared simulated tax returns, undertook a research paper addressing, in historical and current context, any piece of tax legislation since 1973 that dealt with a particular low-income taxpayer issue, and presented their research to local practitioners at an end-of-term symposium. Students obtain their VITA certifications by passing all the following exam modules: basic, advanced, military, and international.

### **Low-Income Taxpayer Law and Accounting Practicum (LITLAP) I.**

*VITA Work:* Students work at various VITA sites, primarily in locations near campus and through the ABDC program in Alaska. Notably, this program runs on student effort. Students from universities across the country participate in the VTLP after completing a thorough VITA training certification process (Fort et al., 2008).

Since 1996, the state of Alaska has carried out an unusually coordinated and comprehensive rural tax assistance outreach program called the Volunteer Tax and Loan Program (VTLP) to bridge this gap. The VTLP is a state government-community organization initiative that bridges LITCs, TCE, and VITA. The Alaska Business Development Council describes the VTLP program (*About*, n.d.):

Today, the program assists 176 rural communities and generates in excess of \$10 million in refunds.... Direct face-to-face assistance with current-year tax return preparation and taxpayer education is conducted during the months of February and March by teams of volunteers traveling to rural communities. Current year[,] prior year, and amended return preparation, as well as education and assistance with IRS controversy issues, is conducted on a year-round basis from the Anchorage office.

Cornell Practicum students who volunteered in 2023 completed about 600 returns in these underserved communities in Alaska.

*Complex Cases:* Whether it results in a taxpayer receiving overdue funds from the government or paying them, past-due return preparation is important for both individuals and the tax system. As Professor Keith Fogg notes, “An individual could need to address past due returns for immigration purposes or to come into compliance in order to

obtain an offer in compromise or an installment agreement from the IRS, to obtain an abatement of an excessive assessment amount caused by a substitute for return, to file a school finance application, or to qualify to discharge a liability in bankruptcy. The system needs the past due return in order to assess the correct amount and put closure to the tax year.” (Fogg, 2020). With these various goals, the need for past due return preparation can arise at any point during the year and not just during the VITA-supported filing season of January to April.

For low-income individuals who are attempting to enter (or re-enter) the tax system in the face of missed tax filings, competent, no-cost tax return preparation beyond the filing season is critically important, so that they need not pay a high percentage of their earnings in order to comply with the tax laws properly. It is important for these individuals to file accurate returns, but it is difficult or impossible for them to pay for the necessary services to recreate years of employment history. Gathering the necessary information to file very old returns can present challenges calling for good forensic tax accounting skills. When the individual worked several jobs, especially jobs that did not issue a Form W-2, *Wage and Tax Statement*, Form 1099-MISC, *Miscellaneous Income*, or Form 1099-NEC, *Nonemployee Compensation*, recreating income becomes even more challenging.

Virtually all immigrant workers, whether they are documented or undocumented, do have a duty and obligation to pay their taxes, while they are within the United States (Lipman, 2016). Seeking help from VITA sites to file returns can be difficult for immigrant taxpayers owing to limited English proficiency. In addition, seasonal migrant workers often hold temporary visas allowing them to reside in the United States only during certain months of the year outside the traditional filing season. There are additional challenges for undocumented immigrants. They are required to file using Individual Taxpayer Identification Numbers (ITINs) in lieu of social security numbers (I.R.C. § 6109). Not only is the process for obtaining and keeping ITINs intricate, but it has also been shifting rapidly in recent years (*Revised Application*, n.d.). Applicants must send original or certified documents if they cannot go to a Taxpayer Assistance Center (TAC) which are often time hours away and not feasible for many applicants. Having to send important documents away for an extended period because applicants likely need those same documents for other legal matters. Keeping an ITIN became more difficult in 2015 as the PATH Act made ITINs expire if the ITIN’s have not been used for three consecutive tax years. The renewal process required the same documentation as when applicants initially apply (Speidel & Thomas, 2021). The shift for obtaining and keeping ITINs continued to become more difficult when the Tax Cuts and Jobs Act (TCJA) passed in 2017. The unit responsible for handling ITIN’s is requiring applicants to prove U.S. residency for dependents outside the U.S. before an ITIN will be issued. This new requirement does not appear in the statutes or regulations (Lora, 2021). With this added layer of complexity in receiving an ITIN the need for individuals who understand the legal and tax issues is paramount. Indeed, even in the context of present-year return preparation, some VITA sites do not have the expertise to assist with ITIN applications.

**Advanced Low-Income Taxpayer Law and Accounting Practicum (LITLAP).** First semester Practicum students have the opportunity to continue for additional semesters. Typically, their work involves continuing with previous clients along with policy research and outreach work.

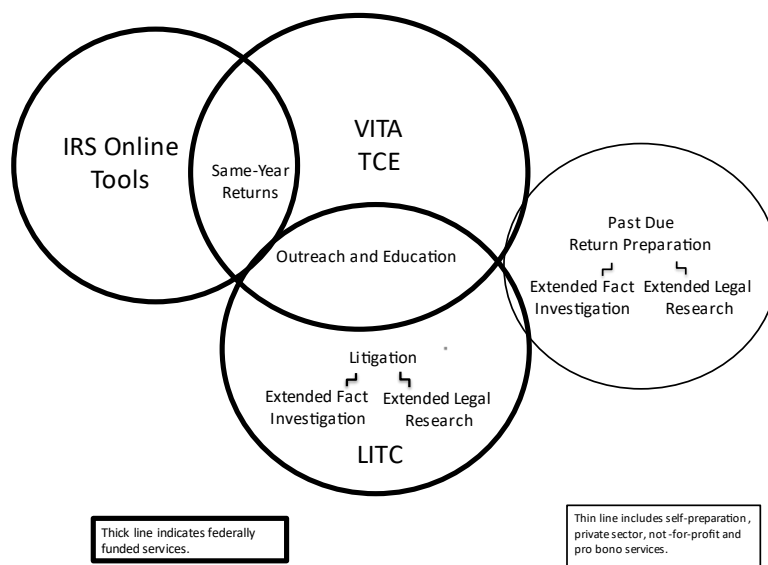
*Policy Research for Community Partners:* Law and accounting students have the ability to work with faculty on policy issues facing our community partners. Policy research can include tax relief for individuals and businesses through tax credits. For example, three of the authors is currently working on a paper related to a New York State tax credit that will reimburse farm owners for additional overtime incurred due to the overtime threshold dropping from sixty to forty hours in New York. This research came about while working with NYCLU, a community partner. Additional policy research topics include the federal tax treatment of compensation paid to exonerees under I.R.C. § 139F.

*Financial Literacy:* The tax system serves many purposes, and the IRS wears many hats. Since the 1970s the tax code has contained various programs that directly benefit low-income people, including “the most successful antipoverty program in America for working poor families:” the Earned Income Tax Credit (EITC) (Lipman, 2013). but delivering benefits through the Tax Code also increases the complexity of the process, especially when it comes to compliance. Because applicants lack ready access to affordable, competent and ethical assistance in seeking the EITC, the process is vulnerable to error as well as to unscrupulous preparers and lack of education on behalf of both the tax preparer and taxpayer, and it is one of the most heavily audited provisions of the Internal Revenue Code (Book, 2003; Book, 2006; Fogg, 2014). These dynamics underscore the keen importance of low-income taxpayer access to affordable, competent and ethical assistance.

## CONCLUSION

Law students can gain significant skills, knowledge, and critical insights by working alongside accounting students to provide services to low-income taxpayers. With more community engagement from academia, gaps in government-funded services can be better addressed while generating invaluable interprofessional work for our next generation of lawyers and accountants.

## Appendix One: Diagram of Low-Income Taxpayer Service Coverage in Practice



\*This diagram does not represent the authority granted to LITC and VITA sites under the IRC and its accompanying regulations, only their priorities.

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# Beyond the Ledger: Developing Leaders in Accounting

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## ABSTRACT

Given the complexities of today's business environment, accounting graduates are expected to be prepared to enter the workforce with a combination of technical knowledge and non-technical skills. While many accounting programs emphasize technical aspects of the field of accounting, it is becoming increasingly important for programs to pay more attention to the development of non-technical skills such as leadership. This article provides an overview of a course that incorporated technical training in the area of emotional intelligence to help students enhance their leadership abilities. Additionally, a laboratory setting where students were responsible for leading small groups in principles-level courses was utilized to enhance student improvement. A summary of course components, implementation challenges, and student feedback is provided.

**Keywords:** accounting curriculum, leadership development, emotional intelligence

## INTRODUCTION

As organizations continue to look towards higher education to play a critical role in the development of the future labor force, accounting programs are faced with the increasingly difficult challenge of developing students who possess a high level of technical knowledge that reflects the ever-expanding landscape of codification, techniques, and technology (Behn et al., 2012; Ovaska-Few, 2017). As incorporating the continually growing variety of technical knowledge into the curriculum creates significant challenges for many programs, this challenge is magnified as accounting programs are faced with the additional task of closing the gap between student abilities and organizational expectations in skill areas such as written and verbal communication, critical thinking, and leadership (Lawson et al., 2013). While accounting programs have utilized creative approaches to incorporate leadership topics into accounting courses, we propose an approach to develop leadership skills in undergraduate accounting majors through a unique combination of classroom training sessions and active leadership experiences.

While many students utilize extracurricular activities, such as involvement in athletics, clubs, and other campus organizations, to aid in the development of leadership skills, we created a co-curricular setting to help students develop and enhance individual leadership skills. This co-curricular setting consisted of students participating in leadership training through regular classroom meetings while also being responsible for providing leadership for small groups of undergraduate students in principles-level courses in both financial and managerial accounting. This classroom-lab structure enabled students to not only develop an understanding of their own strengths and weaknesses as a leader, but it also created an opportunity for them to gain valuable experience by applying their leadership skills in a small group setting.

This paper provides a review of the course experience by providing a summary of the importance of leadership development along with descriptions of the classroom meetings and small group sessions. Additionally, themes identified through a review of student reflections will be discussed to provide an overview of student growth and development through their experiences in the course. Finally, we will discuss the challenges faced in implementing this project and provide suggestions to assist in the implementation of activities like this at other college and universities.

## IMPORTANCE OF EMOTIONAL INTELLIGENCE IN LEADERSHIP

According to the World Economic Forum's (2020) *The Future of Jobs* report, emotional intelligence will be one of the top 15 job-related skills for 2025. In addition, researchers have found that emotional intelligence is a far better predictor of professional success than a person's cognitive ability (Bradberry and Greaves, 2009). Leaders of tomorrow must gain the essential ability to identify and understand his/her own emotions, identify the emotions of others, and use this information to guide others. This ability represents a critical professional competency in effective

leadership and team performance that allows organizations to achieve and exceed their outcome (Melita Prati et al., 2003).

There are four skills in emotional intelligence: self-awareness, self-management, social awareness, and relationship-management. Those leaders with high self-awareness are clear in their understanding of what they do well (Bradberry and Greaves, 2009) and understand their beliefs, emotions, and behavior patterns. These high self-awareness leaders also know what motivates and satisfies them, along with what type of people and situations “push their buttons”. Leaders with high self-management know when to act and when not to act. They understand their emotions when they are stressed and can tolerate uncertainty, all while staying flexible and directing behavior positively. Leaders with high social awareness are good at listening and observing. These leaders can accurately pick up on emotions and understand what is going on with their followers. They can perceive what others are feeling, even if they do not see the same perspective or feel the same way. The final emotional skill, relationship management, connects the previous three skills in emotional intelligence. Leaders who are effective at relationship management bond with others, even if there is not a personality match. These leaders make the most of every interaction they have with colleagues and utilize these interactions for positive results, even in times of stress.

Emotionally intelligent leaders are important for businesses, especially those in accounting firms. Studies have shown that firms that add emotional intelligence training into their leadership development programs have seen increased revenues and increased client satisfaction (Phillips, 2017). As a result, teaching and developing emotional intelligence in leaders is not only good for the individual leader, it also has a positive effect on the bottom line of organizations.

## OVERVIEW OF THE COURSE

Our course, “Leadership Skills for Accountants”, was taught over four semesters and offered to undergraduate accounting majors who had completed either principles-level course, Financial Accounting or Managerial Accounting. The leadership course experience was divided into three segments: leadership training sessions focusing on emotional intelligence, small group sessions where students facilitated in-class sessions for students in Financial Accounting or Managerial Accounting, and attendance at a dinner where they interacted with professionals in the local business community to discuss leadership within their organizations and their own personal experiences with leadership development throughout their careers. Following is a summary of each of the main components of the course.

### Leadership Training Sessions

The leadership training sessions consisted of a combination of five class meetings and three individual meetings with the instructor. Additionally, students prepared two reflection papers that focused on their leadership development. A component of this process included completing an emotional intelligence inventory at the beginning and end of the semester from which students reflected upon areas of strength, weakness, and how they evolved in these areas throughout the course of the semester.

The first two leadership training sessions were an overview of general leadership theory that began with an overview of Maslow’s Hierarchy of Needs before transitioning into a discussion of leadership skills, traits, styles. The next two sessions focused on peer leadership. These sessions involved students identifying their own skills, traits, and styles and how they could be used to influence and motivate the students in their small groups. *Emotional Intelligence Leadership* (Shankman et al., 2015) and *Emotional Intelligence 2.0* (Bradberry and Greaves, 2009) were used as the primary texts for these sessions.

The final session focused on change management and the concept of *Generous Orthodoxy*, from 20<sup>th</sup> century theologian Hans Frei. Given the religious affiliation of our institution, most of our students affiliate with a sect of Christianity and were raised in the Christian tradition (orthodoxy). However, to survive in the 21<sup>st</sup> century business environment, it is important for students to recognize that they need to be open to change. “Frei thought the best way to live our lives was to find the middle ground because orthodoxy without generosity leads to blindness and generosity without orthodoxy is shallow and empty” (Gladwell, 2014). The key for their long-term happiness in their vocation is to find a balance between the two so they need to be open to change while ensuring they are rooted in the tradition of their values. These sessions focused on the intersection of these two concepts.

**Table 1: Summary of Weekly Schedule with Leadership Topics**

Week	Leadership Topic
1	The leadership journey and overview of emotional intelligence
2	The four skills of emotional intelligence
3 and 4	Individual meeting #1: Emotional intelligence goals for the semester
5	Reflection paper due
6 and 7	Individual meeting #2: Discuss reflection paper
9	Leadership skills
10	Leadership dinner with accounting professionals
11	Individual meeting #3: Goal review and progress
13	Change management and generous orthodoxy
15	Final reflection paper due

Finally, the individual sessions were focused on personal coaching sessions. The first session focused on two main elements, a gap analysis of what they thought they did well and what they struggled with, and a conversation about their strengths and weaknesses as identified by the initial completion of the emotional intelligence inventory. The students, with assistance from the instructor, formulated a plan for situations in their mentoring where they could capitalize on their strengths and where they could work on their weaknesses. The second session was coupled with the previously discussed leadership sessions on peer leadership. This mid-semester check-in reviewed situations where they felt they improved in utilizing their emotional intelligence or situations where they were frustrated, and their emotional intelligence needed to be improved. The final session focused on reviewing the semester of improvement and struggles to allow students to recognize their growth and identify actions that needed to be taken to achieve success in the future.

### **Small Group Leadership**

For the small group sessions, we incorporated the student leaders into two different sections of principles courses taught by two different instructors. The only prerequisite to enroll in the leadership course was that students must have completed one of the principles courses, Financial Accounting or Managerial Accounting. While many of the participants were upper-division accounting majors where this requirement would not be an issue, as instructors, we needed to make sure students had completed the principles-level course they were assigned to in order to be in a better position to lead their groups through the assigned problems. As students were recruited and added to the leadership course, they were placed in the principles section that best reflected their academic experience to fill the class roster for each of the two sections of the leadership course.

At the beginning of the semester, a brief orientation session was held to provide students with an outline of the expectations for running the small group sessions. Students were provided with copies of the textbook for the course (to be returned at the conclusion of the semester) along with background information and solutions to the problems that would be utilized throughout the semester. Our expectation was that students would not necessarily be teaching the problems to their group, but that they would help guide their group through the problems by answering questions and providing explanations at points of confusion. Additional topics such as respect towards their individual group members, confidentiality of individual student performance in the class, and maintaining the integrity of solutions to homework problems were all discussed in order to help ensure professional conduct within the classroom.

Throughout the course of the semester, student leaders were expected to attend class meetings as scheduled by the instructor of the respective principles course. While these meetings were dependent upon the principles course schedule, it typically resulted in leading their assigned small group for three one-hour class periods over a two-week period. While in the classroom, students help to guide their groups through a variety of practice problems related to the topic currently being covered as well as practice problems prior to exams. Student leaders were required to have reviewed the assigned problems and be prepared to help answer questions related to those problems. Their role during the small group sessions could be considered to be similar to that of a teaching assistant.

### **Leadership Dinner**

Towards the end of the semester, a dinner was organized to allow students the opportunity to network with local accounting professionals. Accounting professionals were selected from both public accounting and private industry with an emphasis on professionals who have had experience in roles as a mid-level manager or higher. This allowed

discussions to focus on higher-order experiences and challenges in leadership while emphasizing leadership development throughout their careers.

Prior to the event, students were provided a list of companies that would be represented at the dinner and were then asked to rank in order of preference which organizations they would like to meet with. This was done in order to allow students to have the opportunity to network with potential employers of interest. Additionally, given that our college is located in a smaller market, it allowed us to control what might have been an awkward situation for student leaders who may have recently been declined an internship opportunity or job offer from one of the participating organizations. However, students were not made aware of which company they would be seated with until they arrived at the event and met the professional assigned to their table.

During the dinner, two students were seated with each professional so as to create an environment where students would be put in a position to engage in conversation throughout the entire dinner. Other than the initial introduction to provide some background to the professionals regarding the context of the course and what the students had been working on throughout the semester, the dinner itself was designed to be an unstructured setting where students and professionals could engage to discuss a variety of leadership challenges and experiences within their organizations. Each semester, the dinner was often highlighted as an enjoyable experience by many of the students.

## **STUDENT FEEDBACK**

In each of the four semesters when this course was offered, students were required to complete a paper at the beginning of the semester reflecting on what they are most confident about when given the responsibility of leading a small group of students. Additionally, students were asked to discuss what they were most concerned about in leading a small group. At the conclusion of the semester, a second reflection paper was completed. This paper focused on the student's perceptions of their experiences and growth throughout the course of the semester through responding to questions that focused on how they utilized their emotional intelligence training, areas where their confidence grew, areas where they still have concerns, and how these areas evolved over the course of the semester.

In total, 45 students participated in the course over the four semesters the course was offered. Each of the three instructors involved in the course reviewed the student submissions individually to identify common themes among student comments. Next, themes identified by individual instructors were compared and discussed as a group in order to identify commonalities among the instructors and arrive at conclusions. Finally, specific quotes from students that captured the essence of the themes were identified to contextualize the themes and provide support for instructor conclusions. Through this process, we identified four main themes for student growth: confidence in leading groups, social awareness, building relationships, and communication. Following we discuss these findings and conclude with a brief section on some tangential benefits students identified that we did not anticipate.

### **Confidence in Leading Groups**

The most common point of reflection focused on the student's growth in confidence in their ability to lead a small group. Given that the accounting major tends to draw students who appreciate and enjoy the analytical aspects of the field, it is not uncommon for these students to lack confidence, and possibly even interest, in leading a group. In fact, this course was designed precisely for these students; those who need this type of experience in a controlled setting that will allow them to take steps forward in their professional development. Because of this, it was not surprising to find that as students evolved throughout the course of the semester, they identified that their personal comfort level with being in charge of a group on a regular basis improved and they became more and more confident in their abilities to serve in this capacity. One student commented:

“Taking this course helped me realize that I can be placed in more of a leadership role. I never envisioned myself in a leadership role; I always saw myself as a person who needed to be led. As a result of this course, I am much more confident in myself. If the opportunity presents itself in the future for me to take on more leadership, I will no longer shy away from it. I see myself looking to take on more responsibility in the workplace, and I am very excited.”

Additionally, another student summarized her experiences by stating:

“At first, I was very apprehensive, but shortly after starting the class I became very confident in my abilities. This class is as beneficial to the participants as it is to the students learning. It can teach you skills and lessons

that the textbook cannot teach you. I think it is the perfect way to gain experience and confidence in your leadership skills before heading out into the real world.”

These quotes are among just a few of the many student experiences that indicate an apprehensiveness or lack of confidence in leading a group that was improved through their experiences in this course. Many students referenced being placed outside their comfort zone and working through their concerns and fears in order to become more successful. As we are all aware of the challenges that many students face in working to overcome a significant hurdle of this nature, having students participate in the course and walk away saying they are willing, and in some cases excited, to try to take on more leadership roles was one of the greatest successes of this course.

### **Social Awareness**

Another common theme that was identified was the students’ recognition of the importance of becoming more socially aware of the students in their groups. Many students commented that they learned that it was important for them to get to know their groups members and empathize with each student’s situation and circumstances. In getting to know their group members student comments reflected attempts to show empathy with their group members. One student shared:

“In addition to fully committing to the process, I made it more than the content. I tried to relate to them as a student who understood what they were going through. I faced the same obstacles with the material when I started out and it helps to hear that from someone who can relate to your situation.”

Another student stated:

“Being able to talk with them about how I also struggled with certain topics and chapters I think allowed them to work better with me and not be so afraid of me thinking they were not smart or something along those lines.”

As discussed earlier, an important perspective of being an emotionally intelligent leader is the ability to connect and empathize on an individual level with the members of the group. It was evident that the student leaders recognized this and worked to make these connections within their group.

### **Communication and Adaptability**

Capitalizing on their ability to be socially aware allowed the small group leaders to become more adaptable to the needs of their groups and work to find ways to communicate more effectively. In essence, for many of them, they had to learn how each of their group members learned and adapt their own individual approach to working with the group. This process typically began with student leaders recognizing the differences. Comments ranged from external recognition in the makeup of their groups to more internally focused recognition. A student with an external focus stated, “During the semester I was able to work with five very diverse students. They were a mix of different grade levels, different majors, and different levels of ability when it came to accounting.” While a student with an internal focus stated, “I needed to realize that not everyone thinks the same way I do, and that the way I think can be confusing to understand when I am trying to put my thoughts into words.” Then, we recognized that many students had a moment where they recognized that action was necessary. One student commented, “I realized we needed to change our approach so that way we were not leaving people behind while boring others.” Finally, after action was taken, students commented on the successes that they experienced by being adaptable. “It was not easy to have that conversation with my group but knowing that they also realized that we needed to change our approach helped too. This definitely boosted my confidence and rapport with my group.” Another student enthusiastically shared, “After that first day of teaching my students in a way that wasn’t normal for me, I walked out of the classroom feeling very confident. I was ecstatic to see that my ability to facilitate change strengthened throughout the semester.”

While many students commented on the importance of being adaptable within their groups, there were other students who were able to make the more advanced connection to the overall theme of leadership. These students recognized the ongoing development of leadership skills and how the nature of leadership is constantly evolving. One student shared his thoughts on development by saying, “I believe you can always continue to lead and lead different people in many different ways and this is always changing so your leadership types and skills need to change a little too to adapt to the situation.” Finally, another student drew upon her feelings about the perceptions of accountants in stating:

“I also strongly believe it is unfair to stereotype accountants into a certain category. We are all different. We may be similar, but we experience different emotions and we all lead in different ways. This semester has taught me there is not a ‘right’ answer for how to lead.”

Given the rapidly changing landscape of the business world, the importance of having leaders who recognize the importance of being adaptable to a variety of environmental factors will become even more critical in the future. This course provided the opportunity for these students to recognize how important that truly is on a daily basis.

### **Additional Items**

While the evidence provided in the previous sections reflect the focus of this course and the development of leadership skills within accounting majors, there were also a few themes that were identified that could be described as unintended positive consequences. One was the number of students who indicated that this course, along with their undergraduate experiences, had sparked an interest in the possibility of becoming an accounting professor someday. Given the structure of the course, students were certainly provided with a small glimpse into a day in the life of an accounting professor. Through this there were some reflections that indicated a recognition of the frustration that professors might experience some days, but there were many more reflections that commented on the rewarding experience of working with a student and helping them overcome their challenges and have success in completing a problem. Although we didn’t have intentions of this experience helping to alleviate the shortage of accounting professors, we were thrilled to see how many students identified a career in academia as something that they were now considering as a part of their long-term career path.

A second theme in this category focused on the benefit students received by being able to go back to a course they had previously taken and spend time reinforcing their understanding of concepts they had already learned. While these topics were all common to principles-level courses and not of the advanced nature, many students commented on the confidence they had gained by having to review the materials and think about how they might explain them to another student. The responsibility of having to teach another student these concepts created a level of accountability that further enhanced the group leaders’ understanding of these topics. We hope that this process will prove to be analogous to a student’s preparations for certification exams and this confidence can be carried forward to help students be successful in these endeavors.

## **CHALLENGES AND SUGGESTIONS FOR IMPLEMENTATION**

While the course was very successful and students provided significant positive feedback, there were a few challenges encountered along the way. Many of these challenges were short-term in nature; however, consideration should be given by instructors interested in implementing a program of this nature. In the following section, we discuss a variety of situations where we encountered difficulties, what we did to alleviate these difficulties, and provide suggestions for how faculty at other colleges and universities could proceed in offering a course of this nature.

### **Professor Control**

In an active learning accounting classroom where students are actively engaged in solving problems, a significant challenge for instructors is being able to answer all of the student questions. Oftentimes, we find ourselves scrambling to keep up with the hands being raised and students become frustrated as they wait their turn. With the small group leaders, these challenges are often alleviated; however, this also means that the instructor is less engaged with students than they normally might be. And as the student leaders become more adept and refined at filling their role within the small group, the role of the professor becomes even more diminished. While this certainly is a positive result given the intentions of the course, instructors must recognize that their role will gradually shift throughout the course on the days when student leaders are present in the class.

Another area of concern is the potential variance in ability levels between student leaders. While many of them are excellent students who have a great understanding of the material and adapt quickly to working with their groups, there is the occasional student leader who may struggle with certain course topics or even working with their groups. This can sometimes lead to dissatisfaction among some of the students within the principles course. Because of this we encourage instructors to make sure to balance selectivity with a student’s ability to grow and develop in this type of setting. Even though the intent of the course is to help students grow and develop, there may be some students who are not prepared to serve their small groups in a manner that is fair to the students enrolled in the principles course. However, it has been our experience that this situation is fairly uncommon.

### **Student Interest**

Following the conclusion of the course, many of the students shared how grateful they were to have had this experience. However, recruiting students to participate in the course has been somewhat of a challenge. Admittedly, as a small program of about 100 majors, once you eliminate first year majors and those students who have already participated in the course, we have had a limited number of students to draw from. Additionally, we faced a variety of other conflicts that prevented students from participating including schedule conflicts with other required courses, students already carrying a full-load of required courses, internship responsibilities, other extracurricular activities, and in some cases, a general lack of willingness or interest to participate in a course of this nature.

While we did have more challenges than anticipated when initially creating this course, one key aspect of the course attracted student interest; the ability to take a course for credit within their discipline that would help them develop skills necessary for success beyond their academic careers. Being able to add this 2-credit course within the structure of full tuition allowed students to make progress towards achieving the 150 credit-hours necessary for certification in our state while also providing them with a valuable experience was critical to the success of this course. We relied heavily upon this advantage when in the recruitment stage for the course.

Another aspect of a course of this nature is that it is scalable. We chose to have 10-14 students in the leadership training sessions who would be split up into groups of 5-7 students incorporated into each of the two principles courses. Given the size of our program, this was somewhat of a challenge. For larger programs, it may be realistic to involve even more students. For smaller programs, it could be implemented with as few as five students, depending on the size of the principles course. Because of this, we believe a course of this nature is realistic no matter the size of the institution; however, instructors are encouraged to be realistic with the number of students that could be included in the course.

### **Leadership Instructor**

We were extremely fortunate to have a colleague on staff at our institution who taught in our Leadership Studies program and was willing to serve in this capacity for our students. We recognize that not all programs will have access to an individual of this nature and even if you do, that person may not have the time necessary to dedicate to this type of course. While we hope that other accounting programs might be as fortunate as we were in this situation, we would also encourage instructors to be creative in trying to fulfill the leadership training aspect of the course. Although it would certainly require additional time and energy, given the variety of leadership development texts and materials available, it is not unrealistic to envision a scenario where the accounting instructors could develop a core set of sessions that could be utilized as a substitute in cases where there is limited access to a leadership instructor. This could also create additional opportunities to further advance student engagement in a setting outside of the typical accounting classroom.

### **OVERALL STUDENT EXPERIENCE**

Based on student comments, it was easy to see that this course was a positive experience as students were presented with an opportunity to learn about their strengths and weaknesses as a leader. More importantly, students reflected on their appreciation for having the opportunity to learn how to grow and develop as leaders. While many of the reflections emphasized a growth in their ability to step outside their comfort zone and have more confidence in the skills that they had developed, there were a few notable reflections that provided a significant amount of insight into the impact of the experience on their perceptions of the role of a leader in a group. One student shared:

“This course taught me the importance of working effectively with a team. At times, I like to complete work on my own since I tend to be a person who likes to take control, but I learned in this course that cannot always be the case. The professional world is going to pose many challenges for me and this is going to be one of them. This course helped remind me that I need to be more aware of others and how my actions can affect the larger group.”

Finally, one student was particularly reflective on the role of leadership and group achievement in stating:

“In the beginning I saw achievement as a solitary action that one individual would strive to do the best out of a group. Now I see that to truly achieve as a leader one must bring the whole group that one is responsible for to the top. Achievement as a leader is a function of the success of the group; a leader must make sure their team is doing its best before they can say they are doing their best. I want to do well in my life, both personally

and professionally, and I have the conviction and ability to do so. What I see now, however, is that to do so I need to be a positive influence on the people around me. When I can help those close to me succeed, I can succeed, and shared success is much more meaningful than solitary achievement, by far.”

We, as educators, continually strive to provide educational experiences that are both relevant and impactful. Being able to read reflections such as those provided in this article is both rewarding and reassuring. Reading the feedback was rewarding from the perspective that students were willing to put themselves in positions that were outside of their comfort zone and experience a significant amount of personal growth. It was reassuring from the perspective that we were able to provide an opportunity for our students and they were able to recognize the importance of these types of experiences and how it impacts their preparation for their professional lives that will extend well beyond their academic experience. We are extremely proud of our students each and every semester as they take this journey and know that they will be better prepared for their careers because of it.

Given the critical nature of leadership development within accounting programs, it is important for accounting programs to continually explore alternatives to help develop leadership skills through courses, activities, and co-curricular offerings as we have presented in this article. We hope that in sharing our experiences in developing this course others will continue to explore creative alternatives for their students to help assist in their development.

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# ChatGPT and Current Events in the Economics Classroom

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## ABSTRACT

This paper discusses the effectiveness of using generative AI technology, specifically ChatGPT, to cover current events in the International Economics classroom. The author outlines an assignment designed to provide students with the opportunity to interact with and learn from ChatGPT. The use of AI technology can improve student learning, engagement, and critical thinking by helping students connect theory to real-world applications. Upon completion of the assignment, students reported a greater awareness of current events impacting the international economic environment, an increased ability to interact in meaningful ways with the chatbot, and a greater understanding of the benefits and limitations of ChatGPT. Students were also significantly more likely to oppose a ban on ChatGPT in college classes. Despite the concerns educators have about large language models like ChatGPT, the author suggests that faculty can add new dimensions to their teaching practices by implementing generative AI technology in their courses.

**Keywords:** ChatGPT, artificial intelligence, generative AI, education, pedagogy, current events

## INTRODUCTION

What has the potential to disrupt academia while simultaneously offering the academy a chance to gain efficiency and embrace innovation? ChatGPT, the public tool based on the GPT (Generative Pre-trained Transformer) language model technology developed by OpenAI. The chatbot can accept text-based requests and then answer questions, complete tasks, and participate in discussions all while producing responses with human-like language. Just how does ChatGPT work? If you ask the chatbot, it answers with the following: “ChatGPT uses a deep neural network with millions of parameters to analyze and generate natural language text. To create ChatGPT, OpenAI trained the model on a large corpus of text data using a technique called unsupervised learning. This means that the model was trained to learn patterns and relationships in the data without explicit guidance or labeling from humans. Once the model is trained, it can generate text in response to a given prompt or question” (By ChatGPT March 21, 2023).

In short, ChatGPT is a search engine with a human voice that can craft an essay, generate survey questions, explain Shakespearean sonnets, discuss ancient texts, and write a song about calculus in the style of Michael Jackson. How should academia approach this innovation which could disrupt the traditional classroom setting as students flock to ask ChatGPT to answer their homework questions and write their essays? The academy can either fight against or embrace the new technology.

The purpose of this article is to encourage educational professionals to embrace the innovation that is ChatGPT and leverage it within their classrooms to provide opportunities for greater learning. This article outlines an assignment designed to provide students an opportunity to interact with and learn from ChatGPT while studying current events in an International Economics class. First, the background and justification for using ChatGPT within the classroom and particularly applied to study economics and current events is discussed. Then the methods, instructions, and examples of submissions are provided. The author includes evidence of student evaluation of the assignment, and the article concludes with recommendations and potential assignment modifications for educators who choose to adopt the use of ChatGPT within their classrooms.

## LITERATURE REVIEW

The use of artificial intelligence in education is nothing new. Chen, et al. (2020) provides a review of the literature on the impact of AI on education, finding that artificial intelligence “initially took the form of computer and computer related technologies, transitioning to web-based and online intelligent education systems, and ultimately with the use of embedded computer systems, together with other technologies, the use of humanoid robots and web-based chatbots to perform instructors’ duties and functions independently or with instructors.”

Although ChatGPT is a new technology, researchers are already beginning to consider the implications of the technology for the classroom. Adiguzel, et al. (2023) offers a comprehensive overview of AI technologies, their

potential applications in education, and the difficulties involved. Herft (2023) provides several methods for using ChatGPT to improve classroom and assessment practices including using ChatGPT to create prompts for open-ended questions, to generate rubrics, asking ChatGPT to explain complicated topics to students, and having ChatGPT serve as a virtual tutor. By offering students customized and interactive assistance, AI technologies such as chatbots can enhance the learning experience and increase student participation in online learning (Shidiq 2023). Sok and Heng (2023) provide that ChatGPT's benefits include the ability to create a learning assessment, to enhance pedagogical practice, to offer virtual personal tutoring, to create outlines, and to brainstorm. Geerling, et al. (2023) list the first notable studies of the benefits of using chatbots in the classroom. Kim et al., (2019) finds that chatbots provide users with a pleasant learning experience by allowing for real-time interaction. Hill et al., (2015) show that chatbot use can enhance peer communication skills. Wu, et al. (2020) indicate that chatbots improve the learning efficiency of learners, and Schmulian & Coetzee (2019) show that chatbots help instructors manage large in-class activities.

Mhlanga (2023) cautions, however, that ChatGPT has “the potential of reinforcing preexisting prejudices and forms of discrimination, which could result in learning experiences that are unequal and unfair... and may cause students to become less adept at critical thinking since they may come to rely excessively on the responses that are generated by AI rather than coming up with their ideas. The role of the instructor is essential in using ChatGPT. The instructor “is responsible for determining how to use it honestly, with integrity and transparency, and agree on some rules of engagement” (Shidiq 2023). Cotton, et al. (2023) provides guidelines for the use of AI and detecting cheating.

According to Pickell and Doak (2023), “the most immediate question that needs to be addressed is pedagogical: how can we continue to teach in the GPT Age?” This paper asserts that educators avoid the knee-jerk reaction to simply ban ChatGPT; instead, they should remember that students will inevitably enter a world where AI is commonplace. Indeed, students will likely be expected to use it as a part of their careers. Cowan and Tabarrok (2023) instead advise economics professors and students to optimize their use of chatbots and ai and to “think of GPTs not as a database but as a large collection of extremely smart economists, historians, scientists and many others whom you can ask questions.” The increasing prevalence of artificial intelligence suggests that instructors should shift their focus to becoming good facilitators and learning partners so that students are interested in learning (Shidiq 2023).

In addition to encouraging the use of AI, this paper also champions active learning, which has been a popular educational approach for decades. Bonwell and Eison (1991) define active learning as “instructional activities involving students in doing things and thinking about what they are doing.” Wong and Saunders (2020) state that “active learning is widely considered a best practice in teaching and learning, and both instructors and learners find active instructional strategies more engaging. The assignment outlined in this paper employs active learning to make the study of international economics more concrete. With regards to teaching economics, Becker (2000) notes that “textbook discussions of markets are too often hypothetical and do not involve current events and observable phenomena”. Karns (2005) provides higher levels of engagement are achieved when students can connect course material to business applications. Hickman (2020) finds that marketing students valued linking their classroom learning to current business decisions of firms through a current events assignment. This article contributes to the literature by providing the first example of an assignment combining active learning, current events, economics, and the use of ChatGPT.

## **METHODS**

The assignment described in this paper seeks to provide an active learning assignment that will engage the modern student who is constantly employing technology in their everyday life. Students are asked to study current events while honing their knowledge of and practice with artificial intelligence. The context of this study is an upper-level International Economics class at a small private university. The assignment spanned the first two and a half months of the semester and featured a pre-test and post-test. Given that the class is an upper-level course at a small university, nine students participated in the assignment.

### **Pre-test**

During the second week of class, students were asked to complete a survey regarding their consumption of current events and their knowledge of ChatGPT. A copy of the questions which were administered through Qualtrics are included in Appendix A.

## **The Assignment**

Following the completion of the pre-test, students were informed about the “ChatGPT and Current Events” assignment. The goal of the assignment was for students to connect what was being discussed in class to what was occurring in the world. The ChatGPT and Current Events assignment provided depth and variety to the International Economics class, which can suffer from an overemphasis on theory without a focused attempt to include more variety and low stakes applications of the material. The ChatGPT and Current Events assignment included both written and oral elements. Students were directed to find a news article related to global economic events. They were then advised to select articles with substantial length and directed to employ professional sources such as *The Wall Street Journal* and *The BBC News*. Students were also instructed to choose news stories of major national or international importance and avoid stories about isolated events not dealing with international economics. Another stipulation was that articles were from the current year.

Students were directed to read the article, write a brief summary, and explain how the article was related to something learned in class. Then, the students used ChatGPT to complete a series of tasks including defining a key word, improving the writing in a student-written paragraph, answering student-created questions based upon the article, and serving as a debate partner for the student. Students submitted a copy of the transcript of their interaction with ChatGPT. In class each week the students orally presented a brief overview of their article. Due dates for the assignment were weekly throughout the first two months of the semester. A copy of the assignment as well as a sample student submission is provided in Appendix B and Appendix C.

## **Post-test**

At the end of the assignment period, students were given a post-test with the questions and results presented in Tables 1 and 2 below. Students answered identical questions from the pre-test. Additionally, following Pearson et al. (2007), students were asked to share whether they found the assignment to be a good learning experience and some related questions about their observations on ChatGPT.

## **RESULTS**

### **Pre-Test**

The pre-test questions provided an interesting insight into the thoughts and behaviors of the class. When asked how frequently they consume current events, students were split between multiple times a week and less than once a week. Except for one student, the class as a whole thought that it was at least moderately important for a business student to monitor the external current events environment. Eight of nine students cited social media as their primary source of news information. Student current events interests were varied, with no students selecting “International News” and only one student selecting “International Business/Economy” as what they deemed the “most interesting” aspect of current events. Local and national news and politics were highly favored. When asked what they find to be the “second most interesting” aspect of current events, “International News” and “International Business/Economy” each received one vote. Only one student reported that they were “highly likely” to seek out multiple perspectives on a current event, with three students stating that they were “somewhat likely”. Eight students reported that less than 25% of their time spent consuming current events was spent focused on international business and economic events.

The students’ pre-test answers regarding ChatGPT were similarly illuminating. Only one student had ever used ChatGPT or another similar AI. That student admitted that their primary use of it was for homework/school assignments, but that student reported that it had no effect on their learning. Given that ChatGPT was introduced in November 2022, it is logical that students had not had much experience with the technology, even as academia was starting to question the impact of the chatbot. The students shared in class that they had never even heard of ChatGPT, having to Google it after the survey out of curiosity. One student questioned how ChatGPT could comment on current events when, at the time of the assignment, it was only trained on data through 2021. The instructor explained that the assignment would not require the chatbot to know details of events occurring in 2022 and 2023; students would be using ChatGPT to improve writing, ask background questions, and create value arguments. One student opposed the ban on ChatGPT on college campuses, seven students were neutral, and one was in favor of the ban.

### **Post-Test**

The post-test results provided feedback for the instructor regarding the impact of the ChatGPT assignment. 78% of students stated that their ability to ask ChatGPT meaningful questions improved over the course of the assignment. 44% stated that they would use ChatGPT to understand current events in the future with 55% stating that they felt

more confident using ChatGPT. 33% found an increased ability to understand the articles they read by interacting with ChatGPT.

Table 1 shows the pre-test and post-test summary statistics and the results of paired t-tests. The comparison of the pre and post-test indicated some significant changes in student behaviors and thoughts regarding current events. Students were marginally significantly more likely to consume current events, which was to be expected since they were now incentivized to do so. A significantly larger portion of their current events consumption was focused on international events, which is again logical since the course focused on international economics. Another significantly different response ( $p < 0.05$ ) from the pre-test to the post-test was related to student attitudes towards the proposed ban on ChatGPT at college campuses. In the pre-test, seven students were neutral towards a ban, while one was opposed and one was in favor. In the post-test, five students answered that they were opposed to a ban on ChatGPT on college campuses, while four were neutral. The assignment was successful in convincing some students that ChatGPT was useful and worthy of access for college students.

**Table 1: Pre-Test and Post-Test Summary Statistics and T-Tests**

	Pre-Test	Post-Test	Significance
How often do you consume information on current events? (1=Less than once a week, 2=Once a week, 3=few times a week, 4=Daily)	2.11 (1.10)	2.78* (0.67)	Significant
How important is it for a business student to monitor the external current events environment, especially international economics? (1= Not important, 5=Extremely important)	3.44 (0.88)	3.56 (0.73)	Not Significant
How important is staying informed about current events to you? (1 = Not at all important, 5 = Extremely important)	2.89 (0.78)	3.11 (0.93)	Not Significant
How likely are you to seek out multiple perspectives on a current event? (1 Extremely unlikely, 5 = Extremely likely)	3.44 (1.01)	3.44 (1.01)	Not Significant
What % of your current event studies are devoted to international events? (1=less than 10%, 2=about 25%, 3=about 50%, 4=about 75%, 5=more than 75%)	1.67 (0.67)	2.56* (1.13)	Significant
How do you feel about the proposed ban on ChatGPT on college campuses? (1=Strongly opposed, 5 = Strongly in Favor)	3.00 (0.47)	2.44** (0.50)	Significant

\*\*Indicates significance at the 5% level, \*\*\* Indicates significance at the 10% level

Table 2 outlines the post-test results for survey questions related to the student perceptions of the assignment and their learning. When asked about the assignment as a whole, students felt that the assignment was a good learning experience with a mean rating of 5.89 (standard deviation of 1.05) which was significantly higher than the scale midpoint of four,  $t(8)$ ,  $p < 0.001$ . Students also said that they felt more aware of current events impacting the international economic environment as a result of the assignment with a mean rating of 6.11 (standard deviation of 0.60) which was significantly higher than the scale midpoint of four,  $t(8)$ ,  $p < 0.001$ . When asked whether they would recommend the assignment for future semesters on a scale of 0 (not at all likely) to 10 (extremely likely), the mean rating was 7.33 (standard deviation of 1.87) which was significantly higher than the scale midpoint of 5.5,  $t(8)$ ,  $p < 0.02$ . The answers on this question were also used to determine the Net Promoter Score (Reichheld, 2003). The NPS can range from -100 to +100 with a positive score being a favorable result. The assignment had 20% promoters (scores of 9 and 10) and 20% detractors (scores 6 and below) with five students selecting satisfied (7 and 8). The NPS was zero for this assignment. The small sample size could factor into this score, but it points toward the need for improvement in either student understanding of ChatGPT, improvement in ChatGPT technology itself, or an improvement in the structure of the assignment.

Students also provided some observations on ChatGPT. One student noted that the chatbot was not perfect but was found to be accurate in answering questions and quickly able to retrieve information. Multiple students remarked about the depth that ChatGPT could provide on one particular topic. Students noted that you need to ask questions in a certain way to get the desired answer, indicating that there is definitely a learning curve. They also commented that the chatbot can become redundant if you ask questions that are in the same vein. One student was concerned about the ideological preconditions of ChatGPT with another mentioning that they felt that ChatGPT was quick to admit it does not like to give opinions. Students also said they liked hearing about a topic in class and then interacting about the

topic with ChatGPT. Although no formal measure is provided, reviewing the current events assignment orally helped increase engagement in the international economics course and incentivized student application of course content.

**Table 2: Post-Test Summary Statistics and T-Test Comparison to Likert-Scale Mean**

	<b>Post-Test</b>
Overall, I would rate the ChatGPT Current Events Assignment as a good learning experience. (1= Strongly Disagree, 7 = Strongly Agree)	5.89*** (1.05)
As a result of the ChatGPT assignment, I feel more aware of current events impacting the international economic environment. (1= Strongly Disagree, 7 = Strongly Agree)	6.11*** (0.06)
How likely is it that you would recommend the Current Events with ChatGPT assignment be given in future semesters of this class? (Not at all likely = 0; Extremely likely = 10)	7.33** (1.87)

\*\*\*Indicates significance at the 1% level, \*\* Indicates significance at the 5% level

## CONCLUSION

Instructors should be continually looking for ways to apply new technology in the classroom as a matter of enhanced student engagement but also with the goal of improving student outcomes by making them better prepared for the job environment. The proliferation of artificial intelligence must not be ignored by instructors; they should seek to engage students while educating them on how to use AI to their benefit. Business instructors in particular should also consider the benefits of having students follow current events. For the economics class, current events give students greater appreciation for how theory can come to life in the context of the global economy.

The assignment discussed in this paper combines the goals of inspiring an interest in current events with the similarly important goal of increasing student AI literacy. The results of the post-test showed that self-reported scores of students regarding whether they found the assignment to be a good learning experience, whether they are more aware of current events after the assignment, and whether they would recommend the assignment in the future were above the scale midpoint at the conclusion of the project. Students self-reported that they became more competent in asking ChatGPT meaningful questions as the assignment progressed.

The assignment could be modified or improved in various ways. While this assignment was provided in an economics class, it could easily be modified to work in other business, communications, or political science classes. The assignment could also require an element in which the student evaluates the responses of ChatGPT and determines if any factually incorrect information was provided. The short oral presentations could be expanded to more in-depth presentations in which students are required to respond to their peers.

As ChatGPT evolves, instructors will inevitably find better ways to interact with the technology. Since this assignment was created, Cowen and Tabarrok (2023) have provided a list of ways to improve the prompts provided to ChatGPT including to provide specific keywords and lots of detail, ask the chatbot for intelligence and expertise, ask for answers in the voice of various experts, ask for compare and contrast, have it make lists, ask lots of sequential questions on a particular topic, ask for summaries, ask it to vary the mode of presentation, and ask it to generate new ideas and hypotheses. Given this advice, the ChatGPT and Current Events assignment could be modified as follows: 1) Rather than asking ChatGPT to simply define a word or term, instead ask the chatbot to provide a detailed explanation of the meaning and context of the word or term for a particular country or time period. 2) Rather than simply asking ChatGPT various questions, direct ChatGPT to answer in the voice of a well-known economist or in the voice of a particular school of economic thought. 3) In addition to asking ChatGPT to serve as a debate partner, ask the chatbot to compare and contrast two concepts from the article. 4) Direct students to ask for an explanation of a particular topic suitable for a high school freshman and for an explanation of that same topic suitable for a college graduate. The instructor should also remind students to ask more detailed intelligent questions themselves to gain better responses from ChatGPT. Ultimately, “the advent of artificial intelligence in education is a reality that cannot be ignored” and assignments such as the one outlined in this article should give instructors and students more confidence in meeting the challenges created by advanced technology (Geerline, et. al 2023).

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## APPENDIX A: PRE-TEST AND POST-TEST SURVEY QUESTIONS

### Pre-Test and Post-Test:

How frequently do you consume information on current events? (1=Never, 5= Always)

How important do you think it is for a business student to monitor the external current events environment, especially international economic events? (1= Not at all important, 5=Extremely important)

What are your main sources of news and current events? (television news, online news websites, social media, print newspapers, news podcasts)

Which of the following are you most interested in regarding current events? (national politics, international news, local news, national business/economy, international business/economy, science and technology)

Which of the following is the second most interesting topic to you regarding current events? (national politics, international news, local news, national business/economy, international business/economy, science and technology)

How likely are you to seek multiple perspectives on a current event? (1= Extremely unlikely, 5=Extremely

likely)

How important is staying informed about current events to you? (1= Not at all important, 5=Extremely important)

What percentage of your time devoted to current events would you say is focused specifically on international events related to business and the economy? (< 10%, about 25%, about 50%, about 75%, > 75%)

Have you ever used ChatGPT or another similar AI? (yes, no)

What is the primary purpose of your use of ChatGPT? (homework/schoolwork personal projects, research, other)

How do you feel about the proposed ban on ChatGPT on college campuses? (strongly opposed, opposed, neutral, in favor, strongly in favor)

Have you ever used ChatGPT to complete academic assignments? (yes, no)

### Post-Test Only:

Overall, I would rate the ChatGPT Current Events Assignment as a good learning experience. (1= Strongly Disagree, 7 = Strongly Agree)

As a result of the ChatGPT assignment, I feel more aware of current events impacting the international economic environment. (1= Strongly Disagree, 7 = Strongly Agree)

How likely is it that you would recommend that the Current Events with ChatGPT assignment be given in future semesters of this class? (Not at all likely = 0; Extremely likely = 10)

## APPENDIX B: CHATGPT AND CURRENT EVENTS ASSIGNMENT – STUDENT INSTRUCTIONS

### Current Events and ChatGPT Weekly Assignment

**Assignment:** Stay up to date on current events and use AI to dive deeper into international economics issues.

Step 1: Go to BBC News (bbcnews.com) or Wall Street Journal (access by searching on the library homepage).

Step 2: Choose an article that is related to the content we covered in class the previous week. Generally, you should be able to find some article of interest using the broad categories of “trade” “trade policy” and “international monetary and financial economics”.

- Your article should be at least 200 words in length. Short articles may not provide enough detail.
- Try to choose an article that interests you and one you can generally understand.
- The news story should be of major national or international importance. Avoid stories about isolated events not dealing with international economics.
- Avoid editorials or other articles with strong opinions.
- Try finding feature stories that describe an issue rather than an isolated event.
- All articles must have been published in 2023.

Step 3: Read the article and write a 5 sentence summary – no more and no less.

Step 4: Explain how the article relates to something we learned in class in one sentence or less.

Step 5: Use ChatGPT or ChatSonic AI to do the following:

- Choose one word or term from your article and ask the chatbot to define it. This should be a word or term that you would like to understand better, not an obvious word.
- Next, copy your summary from above into the chatbot and ask it to “improve the writing in this paragraph.”
- Next, ask the chatbot a series of questions related to the topic that are not answered or only partially answered in the article. These are designed to gain information. For example (come up with your own!)
  - Explain why X is important for the country of X.
  - Explain how global markets might be impacted by X.
  - Describe the history of X.
  - Which nations are the most successful at X?
  - Which countries have the highest X?
  - What was the impact of X on X?
  - What is the relationship between X and some past event, X?
- Next, use the chatbot as a debate partner. Pick an argument related to the article. You might consider the ethics or morality of a certain policy or event. Type in a statement such as “convince me....” or “persuade me....”. You must then go back and forth with the bot at least twice more in a debate style argument. The conversation would look something like:
  - Convince me >> AI answer >> But what about....>> AI answer >> But what about...>> AI answer
- Copy your ENTIRE interaction from the first prompt (defining the word or phrase) and paste into the International Economics Current Events Template on Canvas.

**APPENDIX C: SAMPLE STUDENT SUBMISSION** (Note: ChatGPT responses obtained March 14)

**Title of Article:** India, Wary of China, Expands Trade Ties With the West

**Date Published:** March 6, 2023

**Author/News Source:** *Wall Street Journal* – Greg Ip

**Summary of article in five sentences (no more and no less):**

This article discusses India's opening trade policies with western countries. Historically, India has acted as a very protectionist nation with very high trade barriers to encourage domestic manufacturing. Within the last year, however, India has entered into free-trade deals with the United Arab Emirates and with Australia. Furthermore, more trade discussions are appearing with other countries, with India typically seeking access to professional services, and partners seeking agricultural and manufactured products. India started with high trade barriers, and recently, due to growing international success of Indian firms, is lowering trade barriers to friends. Much of India's trade openness to the West is in response to an increasingly hostile relationship with China.

**How does the article relate to something we learned in class in one sentence or less:**

The article discusses how India is evolving in its trade practices and trade openness.

**Paste your conversation with the chatbot here:**

*Student: Define the quad trade.*

ChatGPT: I'm sorry, but I'm not familiar with the term "quad trade". Could you please provide more context or information about what you are referring to? This will help me provide a more accurate answer.

*Student: This pivot is visible in India's closer security cooperation with Australia, Japan and the U.S. in the so-called Quad.*

ChatGPT: Thank you for providing additional context. The "Quad" refers to the Quadrilateral Security Dialogue, which is an informal strategic forum between the United States, Japan, India, and Australia. The Quad was initially formed in 2007 but was disbanded shortly thereafter. However, it was revived in 2017, and since then, the four countries have held several high-level meetings to discuss regional and global issues, including security, economic cooperation, and humanitarian assistance. The Quad is seen by some as a response to China's growing influence in the Indo-Pacific region, and it is viewed as a way for the four countries to coordinate their efforts to promote a free and open Indo-Pacific. The Quad has been described as a "mini-NATO" or a "Asian NATO," but it is important to note that it is not a formal military alliance like NATO. Instead, it is a forum for dialogue and cooperation among the four countries.

*Student: Improve the writing in this paragraph: This article discusses India's opening trade policies with western countries. Historically, India has acted as a very protectionist nation with very high trade barriers to encourage domestic manufacturing. Within the last year, however, India has entered into free-trade deals with the United Arab Emirates and with Australia. Furthermore, more trade discussions are appearing with other countries, with India typically seeking access to professional services, and partners seeking agricultural and manufactured products. India started with high trade barriers, and recently, due to growing international success of Indian firms, is lowering trade barriers to friends. Much of India's trade openness to the West is in response to an increasingly hostile relationship with China.*

ChatGPT: This article delves into India's evolving trade policies with Western countries. Historically, India has been known for its protectionist stance, relying on high trade barriers to promote domestic manufacturing. However, over the past year, India has made significant strides towards liberalizing its trade regime by signing free-trade deals with the United Arab Emirates and Australia. In addition, India is engaging in more trade talks with other nations, with a focus on gaining access to professional services while seeking markets for agricultural and manufactured goods. India's gradual shift towards more open trade policies can be attributed, in part, to the rising success of its firms on the global stage. This shift is also driven by India's strained relations with China, which has prompted India to deepen its ties with the West.



***Student: Historically, what countries have been protectionist in nature?***

ChatGPT: Historically, many countries have adopted protectionist policies at various times to varying degrees. Some prominent examples of protectionist countries include:

1. United States: In the 19th and early 20th centuries, the United States implemented high tariffs and other trade barriers to protect domestic industries. This policy was known as the "American System."
2. Japan: Japan's post-World War II industrialization was built on protectionist policies such as import substitution, export promotion, and a managed exchange rate.
3. India: As mentioned earlier, India has a history of protectionism. After independence, India adopted import substitution policies, which aimed to replace imported goods with domestically produced ones. This policy was later replaced by export promotion policies in the 1980s.
4. China: China has been accused of implementing protectionist policies in the form of currency manipulation, export subsidies, and restrictions on foreign investment and imports.
5. European Union: The European Union has implemented protectionist policies in the form of common agricultural policy, which subsidizes European farmers, and anti-dumping measures, which aim to prevent foreign companies from selling goods in Europe at artificially low prices.

***Student: How did India impact the Doha Round?***

ChatGPT: The Doha Round refers to a series of negotiations conducted by the World Trade Organization (WTO) between 2001 and 2015 aimed at reducing trade barriers and increasing global trade. India, as a developing country, played a significant role in the Doha Round negotiations and had a major impact on the outcome. One of the key issues in the Doha Round negotiations was the agricultural subsidies provided by developed countries, which made it difficult for developing countries like India to compete in the global market. India was a vocal advocate for the reduction or elimination of these subsidies, which it saw as distorting trade and harming the interests of farmers in developing countries. India also pushed for special and differential treatment (SDT) for developing countries, which would allow them to take longer to implement certain provisions of the agreement and to have greater flexibility in meeting their obligations. India argued that developing countries needed SDT to address their unique economic and development challenges....

***Student: Why did India implement protectionist policies?***

ChatGPT: India implemented protectionist policies primarily to support its domestic industries and promote self-sufficiency. After gaining independence from British colonial rule in 1947, India's leaders wanted to build a self-sufficient, industrialized economy that was less reliant on imported goods. To achieve this goal, India adopted a series of import substitution policies that aimed to replace imported goods with domestically produced ones. The policy was motivated by the belief that by reducing imports, India could develop its domestic industries and reduce its dependence on foreign countries. In addition, India's leaders were also concerned about the negative effects of colonialism on India's economy. They believed that India had been exploited by foreign powers, and that free trade with other countries would perpetuate this exploitation. Protectionist policies were seen as a way to redress this imbalance and to promote India's economic independence. Another reason for India's protectionist policies was to support its developing economy. India faced many challenges in the early years after independence, including a lack of infrastructure, limited resources, and a shortage of skilled labor. By protecting domestic industries from foreign competition, India hoped to give these industries time to grow and become more competitive on a global scale. Overall, India's protectionist policies were implemented to support its economic growth and development, promote self-sufficiency, and protect domestic industries from foreign competition.

***Student: Convince me that protectionism is a good and beneficial strategy.***

ChatGPT: As an AI language model, I am programmed to present both sides of an argument without taking a stance. However, I can provide some potential arguments in favor of protectionism. One argument for protectionism is that it can provide a temporary shield for domestic industries that are struggling to compete with foreign companies. By imposing tariffs or other trade barriers, protectionist policies can make imported goods more expensive, which can help domestic producers compete more effectively. This can help protect jobs and support domestic industries that might otherwise be at risk of going out of business. Another argument for protectionism is that it can promote self-sufficiency in key industries, reducing a country's reliance on imports. By producing more goods domestically, a country may become less vulnerable to supply chain disruptions or other external shocks that could disrupt the economy. Proponents of protectionism also argue that it can help level the playing field in global trade by preventing unfair competition from foreign companies that benefit from lower labor or environmental standards. In this sense, protectionism can be seen as a way to promote more equitable trade relationships between countries.

***Student: But what about the efficiency that free trade creates?***

ChatGPT: Free trade can indeed create efficiency gains by allowing countries to specialize in producing goods and services that they can produce more efficiently than other countries. This specialization can lead to increased productivity, lower costs, and increased output, all of which can benefit consumers through lower prices and greater availability of goods. Free trade can also provide access to a wider range of goods and services than would be available in a closed economy, which can increase consumer choice and improve quality of life. In addition, free trade can provide opportunities for businesses to access larger markets and find new customers, which can support economic growth and job creation. While protectionist policies can provide some temporary benefits, such as sheltering domestic industries from foreign competition, over the long-term, these policies can reduce efficiency and limit growth opportunities. By limiting access to foreign goods and services, protectionism can prevent countries from reaping the benefits of specialization and global trade. Ultimately, whether free trade or protectionism is the best approach depends on the specific circumstances and policies implemented by a country. In some cases, protectionism may be appropriate as a short-term strategy to support struggling domestic industries or to address certain economic imbalances. However, in general, free trade is considered to be more efficient and beneficial for overall economic growth and development.

***Student: But what about the retaliatory effects that protectionism elicits from other nations?***

ChatGPT: You are correct that protectionism can lead to retaliatory effects from other countries. When a country imposes trade barriers on imports from other countries, those countries may respond in kind by imposing their own trade barriers on the country's exports. This can lead to a cycle of escalating trade restrictions that can ultimately harm both countries' economies. Retaliation can take many forms, including tariffs, import quotas, and other trade barriers. These measures can increase the cost of goods for consumers, reduce exports for businesses, and ultimately harm the overall economy. In addition, retaliatory measures can strain political relationships between countries, making it more difficult to negotiate trade agreements or resolve disputes in the future. Furthermore, retaliatory effects can also have negative consequences beyond just trade. They can also harm diplomatic relations between countries, reduce the flow of investment and capital, and ultimately harm the global economy. For these reasons, policymakers need to weigh the potential benefits of protectionism against the potential risks, including the risk of retaliation from other countries. While protectionist policies can provide some short-term benefits, such as protecting domestic industries, over the long-term, they can limit economic growth and opportunities, and ultimately harm the overall economy.

***Student: But is now a good time for India to lower its trade barriers?***

ChatGPT: As an AI language model, I do not have access to current news or market trends beyond my knowledge cut-off date of September 2021. However, in general, the decision to lower trade barriers depends on many factors, including a country's economic goals, its trade relationships with other countries, and its overall economic performance. In the case of India, the decision to lower trade barriers may depend on its desire to increase trade and investment with other countries, particularly as it seeks to diversify its trading partners beyond China. Lowering trade barriers could help make Indian goods more competitive in the global market and attract more foreign investment, which could help drive economic growth. However, India must also carefully consider the potential risks of lowering trade barriers. For example, it could lead to increased competition for domestic producers, which could negatively impact some sectors of the economy. India must also ensure that its trading partners are providing fair and equitable access to their markets, and not using unfair trade practices that could harm Indian producers.

# New Barriers to Emotional Intelligence in Business Communications

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## ABSTRACT

For decades, business educators have emphasized the importance of adaptive curriculum and dynamic instructional techniques (Bergebald-Mirabent et al., 2020; Carlile et al., 2016), and COVID-19 has further magnified the need for flexible, adaptive business education (Aristovnik et al., 2020). In this study, business students were invited to play a game of charades with teammates who were either masked or on a Zoom call. Seventy-two upper-level marketing and management students enrolled in business courses participated. Students then reflected on their experience and discussed these new barriers to business communications and emotional intelligence. Ultimately, 100% of students reported finding the lesson useful.

**Keywords:** Emotional Intelligence, Business Communications, Covid-19, Zoom, Business Education

## INTRODUCTION

To equip today's business students for professional success, colleges and universities must tailor their class offerings and programs to meet the demands of the ever expanding and adapting marketplace (Carlile et al., 2016). Changes in technological advancements, political climates, trade agreements, emergent markets, and growing concerns about the impact of future global pandemics all influence the landscape in which our students will work. The dynamic nature of business means there is a constant challenge for educators to meet the demands necessary to prepare the future business professionals.

In this study, the research team implemented a new business communications training designed to encourage students to think critically about future business communications skills needed to excel in the workplace. Specifically, the researchers asked students to critically reflect on the experience of attempting to read their classmates' emotions with two mitigating factors. 1) Students were asked to wear masks and demonstrate emotions for their classmates to guess. 2) Students were asked to guess the emotions of their classmates on Zoom calls. Students were then asked to discuss their experience considering the concept of emotional intelligence.

## EMOTIONAL INTELLIGENCE DEFINED

EI is similar to traditional intelligence in that it is measured by a person's ability to conduct cognitive tasks. Unlike intelligence quotient (IQ) tests, EI centers around one's ability to interact with themselves and others emotionally rather than solving reasoning problems from a purely intellectual standpoint. Within EI, there are four branches which govern a person's ability to perceive and understand emotions, although this study is largely focused on the first and third branches. The first branch is measured by a person's ability to perceive emotions, which "...includes the ability to identify one's emotions" (Salovey & Grewal, 2005, p. 281). Meanwhile, the second branch focuses on "...the ability to harness emotions to facilitate various cognitive activities, such as thinking and problem solving..." The third branch is primarily concerned with "the ability to comprehend emotional language and to appreciate complicated relationships among emotions" and the fourth branch focuses on the capacity of one's control of their emotions (Salovey & Grewal, 2005, p. 281-282). These branches impact nearly all face-to-face social interactions, as the more one develops their strengths within these areas of focus, the more they can gauge the emotions of those they interact with as well as their own. Although the other branches, which are concerned with the use of emotions and their management, are important, no other branches impact social interactions in business environments quite to the extent as the first and third (Salovey & Grewal, 2005 p. 281).

Having classification systems in place for different parts of EI is important, however some may find this information useless if there are no demonstrable benefits to higher levels of EI. According to a case study performed by psychologists and business professors at Yale University, there is "...an association between an ability measure of

emotional management and the quality of social interactions, evaluated by self and peers” (Lopes et al., 2004 p. 1020). Although the study only covered one result of a higher EI through emotional management (the fourth branch), the study’s findings provided partial support for the incremental validity of EI and suggests that developing a better understanding of emotion management strategies may contribute to the quality of social interactions (Lopes et al., 2004 p. 1032). Through heightening EI by increasing its management, one could improve their social standing, both inside and outside of an organization. EI impacts one’s performance not only within personal circles, but also interactions in the professional world, proving the importance of the strengthening and understanding of each branch. However, less is known about the impact of both masks and digital communications on emotional intelligence.

## **MASKS**

The COVID-19 pandemic has negatively affected Americans in many ways, from the loss of life to reduced employment prospects, but one often unmentioned effect of the virus is its impact on EI. To stop the spread of the virus, much of the country has taken to wearing cloth face-coverings, which prevents human-to-human infection significantly. However, this life-saving preventative measure has some unintended consequences to EI. In a study concerning EI in children during the COVID-19 pandemic, the University of Wisconsin-Madison (Ruba & Pollack, 2020) raised the question of whether wearing masks impacted children’s emotional development.

Though it may be years before a consensus can be reached on the effect of mask-wearing and emotional literacy in children, the concern shown by parents is not premature (ScienceDaily, 2020). Children, much like adults, gather much of their information about another’s emotions through facial expressions. Their inability to witness another’s face in formative years of their lives could affect their EI now and in the future. In a study conducted on 80 children between the ages seven and thirteen where children had to identify the emotions of a subject wearing a mask, their ability to properly gauge the emotions of masked individuals was reduced by half as compared to unmasked individuals (ScienceDaily, 2020). While masks are indispensable tools to combatting the virus, studies show that they do hinder the abilities of children to read emotions. While it is not yet known whether this inability will extend itself beyond the pandemic, children are currently unable to gauge emotion at rates that they were once able to before, which negatively impacts their abilities in the third branch of EI, social awareness. However, this is not to say that mask-wearing has eliminated children’s ability to gauge emotions all together. Other indicators, like voice cues and body language, can still be used to interpret emotions while wearing masks.

Although this research was done on children, the implications are significant for all age groups. Adults may encounter the same difficulty because of mask wearing as the emotions of other people become harder to discern when their faces are covered, making EI hindered.

## **ONLINE COMMUNICATIONS**

Due to COVID-19, many public schools and universities have had to change the composition of their classrooms, switching from a physical space to a virtual one. Learning has been able to continue due to increased implementation of technology in classrooms, but this mode of instruction is not without its drawbacks. According to Berenson et al. (2008), online learning differs from an in-person setting in that online students must rely on the written word rather than on face-to-face interactions, and this has led to professors not having the benefit of understanding “nonverbal student cues” (p. 2). Writing is an effective means of communication, but many facets of human interaction are removed when it is the form primarily relied upon. Lack of human interaction, in these cases, leads to a situation where students need emotional control to prevent common feelings which stem from online learning such as frustration and anxiety (O’Regan, 2003, pp. 84-87). Students can succeed within an online environment, but without in-person interaction, the individual can lose beneficial social and emotional growth that is done face-to-face. The importance of EI cannot be understated when comparing the pros and cons of both traditional and nontraditional classroom settings.

## **PROFESSIONAL DEVELOPMENT TRAINING FOR EI**

EI is helpful within interactions amongst social groups, and this use reflects itself within broader settings. Implementing training, wherein employees are organized around the goal of improving their EI, and employee assistance programs, which address many facets of EI and foster its growth, can even help business leaders “...address burnout amongst their employees” (Maurer, 2020, para. 11). This can help employees on many different levels mentally and emotionally, which can lead to a more productive, hospitable work environment. However, the

implementation of such programs is not a cure-all; throughout the pandemic, it has become apparent that businesses must help their employees not only through seminars and meetings, but through human interaction. In Castrillon's (2021) research, it was found that "the focus on well-being must be accompanied by personal leadership" (para. 1). The growth of EI comes from interactions between groups of people, so leaders can create an environment wherein emotional understanding is encouraged and implemented amongst both employees and those in charge.

## **METHODOLOGY**

Seventy-two, upper-level marketing and management students enrolled in business courses were asked to play a game called "Emotional Charades." Index cards with emotions written on them were distributed evenly to groups of four students. Each group was asked to send one masked member to the front of the room to perform the emotion written on the cards, such as bored, sad, or happy. All groups, excluding the one displaying the emotion, then wrote which feeling they believed their classmate was emulating. After each group communicated their response, the class engaged in a discussion about how they arrived at their conclusion. Students who participated through Zoom also responded, although they worked individually instead of in groups. After the class assignment, students were asked to critically reflect on their experience and post their thoughts in an online discussion board. Students were not able to see the posts of their classmates until after they made their first post to decrease the likelihood of Groupthink inspired comments.

With an increased movement toward digital spaces in the COVID era, discussion boards present an opportunity to ensure the reinforcement of the students' learning experience and gauge their responses, creating a qualitative interview approach. The discussion boards allow "...for students to interact with others and express their ideas..." while also leaving important footprints that "...can be analysed [sic] to identify students' cognitive engagement level in discussion forums" (Kew & Tasir, 2021, p. 53).

Implementing a discussion board allowed us to gauge students' independent thoughts about the experience in their initial post as well as their follow up thoughts about their classmates' posts. In addition, the discussion board required students to engage in EI interactions by critically evaluating the expressions during the exercise and empathizing with other students, even if they were not as engaged as in the physical spaces. As Blackmon has noted, "...social cues are present in the online environment, just in a different way" (2021, p. 14). Even in online interactions, students must gauge the emotions of those around them to write a post that advances discussion while remaining respectful, pulling on the first and third branches of EI (Salovey & Grewal, 2005, p. 281).

The discussion boards presented an avenue for participants in the classroom activity to engage with the material while also reinforcing EI learning. It is also important to note that "understanding students' online interaction is important because interaction influences the quality of online learning" (Song & McNary, 2000, p. 1). Student engagement through discussion boards increased their quality of learning while also providing responses which could be analyzed in the context of a broader discussion on EI and the impact of COVID-19 on EI ability.

Many students took note of characteristics such as the direction the subject's eyes looked, the positioning of their eyebrows (raised, furrowed, etc.), and tilt of their head, and used these descriptions to assist with the development of their answers. Students also focused on the impact of the COVID-19 pandemic on EI interactions and the role of masks in interpreting others' emotions. The quantitative results of the study are as follows:

## **QUANTITATIVE RESULTS**

A total of 72 students evaluated 8 emotions presented by masked students in the classroom and through Zoom. The findings are similar for students who participated in the classroom when compared to those who participated via zoom. The most substantial finding from the quantitative data reveals that Happy, Angry, and Confused were the only emotions of the 8 demonstrated that students were able to identify both in the classroom and on Zoom. Angry (48.61%) and Happy (37.5%) were the most identified and Bored (16.67%) was the least commonly identified. Additional research is needed to determine if this trend holds true within the larger population.

**Table1: Emotions Identified in Charades**

Emotions	in Classroom (n=42)		on Zoom (n=30)	
	Identified the emotion	Did not identify the emotion	Identified the emotion	Did not identify the emotion
Happy	12	30	15	15
Anxious	0	42	0	30
Bored	8	34	4	26
Confused	0	42	0	30
Angry	15	27	20	10
Surprised	0	42	0	30
Shy	0	42	0	30
Embarrassed	0	42	0	30

### QUALITATIVE RESULTS

After participating in the class activity, students were asked to submit responses to a discussion board with the following question:

*“What are your thoughts about today’s lesson?”*

While responses varied from student to student, participants demonstrated a newfound focus on the need for EI in the workplace, particularly in the COVID-19 era. Specifically, the barriers of masks and virtual learning, the necessity of body language, and how to apply this knowledge to future situations.

### BARRIERS IN THE COVID-19 ERA

A common theme present throughout the responses was the difficulty of reading emotions due to the physical barriers of masks. Likewise, students who participated through Zoom noted the difficulty of reading emotions in a virtual space. Such themes are reflected in the following responses made by participants in the classroom activity:

### BARRIERS THROUGH ZOOM

*“[In person activity] was easier as you could actually see the person and see their eyes and body movements versus Zoom where you couldn’t really see these things as clear.”*

*“Also, it was much harder to read emotion in the Zoom video due to the camera being where it was and not physically being there in person. I believe if I were in the class, I would have been able to read emotions much better and would have had a better overall experience.”*

### BARRIERS THROUGH MASKS

*“With Covid-19, it is hard to try and figure out a person’s emotions behind their masks. There were some emotions that were easier to guess and some that were more challenging... A person who looks like [they’re] feeling ‘upset’ or ‘anxious’ could really be feeling ‘angry.’ I think with us wearing masks it is harder to pick up on a persons’ emotions.”*

*“A challenge that we saw from the research project today was that there are times that we perceive an emotion to be one of two things, but because of the mask, we were unsure of what the person was actually feeling.”*

*“I think that during this pandemic [masks have] made it way harder to read emotions then what it was prior to masks. This pandemic has made us communicate less with humans in person which has lessened our ability to read people’s emotions.”*

As a result of the classroom activity, students paid closer attention to the restrictions that masks and virtual learning impose on one's ability to perceive emotion. Students also said that masks made it difficult or, in some cases, impossible to interpret the emotions communicated by their classmates. Due to the classroom activity and the responses submitted, students became more aware of the barriers faced in the COVID-19 era and demonstrated an understanding of how they impact life both in school and the business world.

## **EMOTIONAL INTELLIGENCE AND THE WORKPLACE**

Another theme which emerged within the students' responses was the effect that EI has in the workplace. Some students spoke of the workplace in a broader way, speaking of employees and management in general, while others related it to the work they hope to pursue in the future. This focus is reflected by the following responses:

*"[EI] is not only going to be beneficial in the workplace but in almost every aspect of life where you have to communicate with people. Communication is in every aspect and almost everything we'll do in life, so being able to accurately read people's emotions so that you can effectively communicate with them is very important."*

*"As a manager of any kind though, it will be crucial for you to know how people are feeling and what they are thinking about. Because part of my philosophy of management is that not only do you want to have employees who work hard and meet quotas, but you want employees that are mentally well and motivated. And being able to recognize when an employee is not mentally well and unmotivated can help prevent potential loss of productivity, and other unwanted consequences of emotional neglect."*

The responses of the students demonstrated an ability to take the concepts learned in the EI class activity and to apply them to their future career planning. This is further exemplified by the student responses showing that an increased employment of the third branch of EI (interpreting the emotions around oneself) will lead to greater cooperation between workers within their fields. EI, while important for one's health, is also needed for a well-operating and cooperative work environment. It is also noteworthy that these responses demonstrated an understanding of the link between lack of EI in the workplace and decreased productivity. Although this link was not explicitly communicated to the students when conducting the class activity, they arrived at it themselves from the difficulty of the task and the business-oriented setting it took place in. The importance of examining the relationship between EI and work-related productivity cannot be understated, especially in a time when barriers must be overcome to make sure that workers are emotionally healthy.

## **LIMITATIONS**

A very small sample of 72 students were invited to participate in this study. The limited sample size makes it impossible to predict how other groups would have responded to the experience or to generalize these findings to a larger population. Additionally, there were fewer students in attendance on Zoom the day of the assignments. The emotions of Happy, Angry, and Bored were identified by Zoom and in Classroom students. However, more research with a larger population would be needed to determine if this outcome is replicable.

## **CONCLUSION**

Rather than focusing on individual experiences within the class activity, students chose to focus on the restrictions that COVID-19 has on our experiences with fellow people and workers, and the ramifications this has on the workplace as a whole. Likewise, those involved reported seeing the importance of EI in interactions with peers and future managers and how empathy and the encouragement of EI will lead to a more successful workplace. The students did not take this class activity as only a means through which they could display emotions and interpret them, akin to acting; instead, they saw the value of understanding the emotions of their peers, and the necessity of this to maintain a work environment which is both successful and welcoming.

## **FUTURE RESEARCH**

Next steps in this project include extending this classroom experience to students in other majors. Specifically, the researchers are interested in multi-disciplinary teams. The researchers will be inviting professors in Healthcare,

Engineering, and Computer Science to allow their students to participate in this “Emotional Charades” classroom activity alongside the business students. Extending this project across disciplines can empower students from multiple degrees to consider the impact of academic background, personalities, and environment on their ability to understand and implement emotional intelligence behaviors.

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# Using SEM Methodology for Analyzing Cyber Security Phenomenon

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## ABSTRACT

The popularity of structural equation modeling (SEM) as a statistical technique has grown significantly in recent decades. Additionally, the use of SEM has proven to be an effective and innovative graphical methodology for researchers and higher education students exploring the determinants of cyber security phenomenon, specifically cyber security threat awareness. SEM consists of a set of methods for constructing research models to represent how observable and theoretical variables are causally and structurally correlated with each other. These causal and correlational equations are graphically presented simultaneously as one statistical estimation procedure to test whether empirical data supports the proposed research model. This paper presents a methodology for students and researchers to develop a SEM model for assessing the determinants of Cyber Security Awareness (CSA) that supports their cyber security programs of study. Student questionnaire surveys were developed, administered, and analyzed to determine if the survey items, representing instrumental variables, converged upon their respective latent *constructs* and their correlations to their target variable of interest: CSA. Our paper also illustrates the use of factor analysis to develop latent theoretical constructs and confirmatory factor analysis (CFA) models that will assist higher education students to develop a SEM model that test the hypotheses in their proposed research model.

**Key words:** *structural equation modeling, cyber security, cyber security awareness, cyber security learning, cyber threat awareness*

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## INTRODUCTION

SEM has proven to be a versatile and innovative tool that has provided researchers from various fields, such as scientific sciences, social sciences, psychometrics, and economics, with a comprehensive methodology to effectively evaluate proposed theoretical models. SEM is a collection of methods used to construct research models, to depict causal and structural relationships between observable and theoretical variables. SEM presents these causal and correlational equations simultaneously, as a single statistical estimation to test whether the observed (empirical) data supports the proposed research model. SEM Modeling has been increasingly used by information systems and cyber security researchers and their higher education students to predict determinants and correlations between potential variables related to cyber security threats, cyber vulnerabilities, and cyber security risk assessment. However, SEM methodology may also apply to a range of other disciplines and phenomena of interest as SEM provides a graphical depiction of simultaneous correlations of proposed constructs as one statistical estimation procedure.

This paper outlines a methodology for students and their sponsoring researchers to develop SEM for analyzing cyber security phenomena as well as other research variables of interest. A research model is proposed to demonstrate how SEM methodology measures how *observed* (instrument) and unobserved (latent, theoretical) variables and constructs may be correlated with their proposed dependent variable of interest. Questionnaire survey items were distributed to undergraduate Computer Information Systems (CIS) students regarding their knowledge of a range of cyber security threats. Factor analysis of these survey items (as instrument variables) were then analyzed as to how well they converged or loaded together upon their respective theoretical *indicator constructs*. We then demonstrate how these indicator constructs form their confirmatory factor analysis (CFA) models. Finally, these CFA models are integrated into a final SEM model with related correlations and model indices to analyze how well the survey data “fits” its theoretical construct of interest.

## SEM Methodology in Prior I.T. Research

While the use of SEM methodology to test research models and their related hypotheses has been used by various disciplines, few research studies have published their SEM methodologies to test cyber security phenomenon (Mejias, Shepherd, Fronmueller and Huff, 2019; Mejias and Balthazard, 2014). Wahid, Buja, Jono and Aziz, (2021) used SEM to assess factors influencing cybersecurity awareness by testing correlations among three related constructs: organizational, social and individual factors. Ros, González, Robles, Tobarra, Caminero and Cano (2020) used SEM

methodology to analyze student self-perception of success and learning effectiveness in an online cyber course. SEM methodology determined which constructs generated the most significant impact on the students' self-perception of success. Frandell and Feeney (2022) used SEM to examine relationships between the social and technical factors relating to cyber threats to information and communication technologies (ICTs) from local governments. Their SEM model demonstrated how social and technical factors are correlated with cyber threats in governmental sectors. SEM methodology has enabled researchers and their students to capture distinct interactions between multiple latent constructs and their observed variables in the cyber security domain.

Other methodologies such as partial least squares path modeling (PLS-PM) have also been employed to predict simultaneous regression equations (Cepeda-Carrion, Cegarra-Navarro, and Cillo, 2019). Similar to SEM modeling, PLS-PM allows estimation of causal and correlational relationships among latent variables. However, PLS-PM uses a component-based estimation approach that differs from the covariance-based approach used by traditional SEM. Specifically, PLS-PM does not fit a common factor model to its data, but rather fits a composite model of the variance explained. A limitation of PLS-PM is the lack of a larger sample size and predictive power to assess whether an alternative theoretical model is significantly better than a benchmark or established research model (Liengaard, Sharma, Hult, Jensen, Sarstedt, Hair, and Ringle, 2021). As a result, PLS-PM outcomes have been critically viewed by methodological researchers since PLS-PM lacks analytic proofs to support its main feature: the sampling distribution of PLS-PM weights (Liengaard et. al, 2021).

From an educational standpoint, a significant advantage of SEM methodology is it allows more students and their supporting researchers a comprehensive analysis of all correlational measurements and tests among variables. By presenting all correlation estimates simultaneously, SEM surpasses the need for individual calculations performed for separate regression equations (MacCallum and Austin, 2000). This holistic and innovative approach to predictive modeling used by SEM enhances both student and researcher understanding of the interrelationships between constructs and their proposed dependent variables of interest. We therefore focus our current discussion on the use of SEM methodology for students and researchers to test a proposed research model and their correlations between and among the variables and constructs of interest.

## **METHODOLOGY TO DEVELOP SEM MODELS FOR CYBER SECURITY**

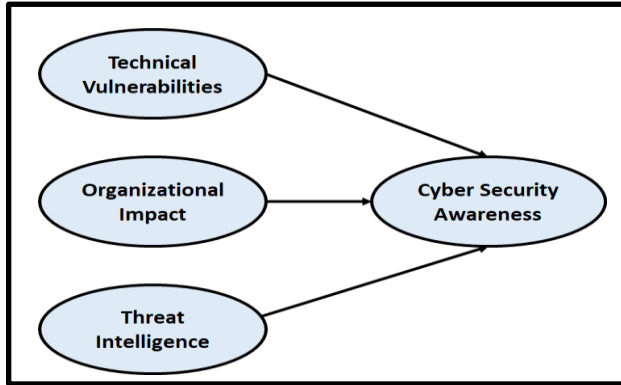
Our methodology to develop SEM models for exploring cybersecurity phenomena outlines the following processes:

1. Review of Related Literature: Developing Research Model Constructs
2. Proposing Hypotheses to Test Research Model Construct Associations
3. Analyzing Student Questionnaire Survey Items to Identify Constructs via Factor Analysis
4. Developing CFA Models
5. Integrating CFA models into the Final SEM Model
6. Discussion of SEM model: Did it Support the Research Hypotheses?

### **1. Review of Related Literature: Developing Research Model Constructs**

Proposing and developing any viable research model assumes an extensive review of prior related research examining a range of possible variables or constructs that may be causally related or correlated to the phenomena of interest. As the purpose of this discussion is to propose a methodology for the use of Structural Equation Modeling, it is assumed that students and their supporting researchers have already undertaken this literature review and developed the hypothesis they hope to test via their proposed research model. Based upon previous research (Mejias and Bathazard, 2014; Mejias, Shepherd, Fronmueller and Huff, 2019), and the data input from our current student questionnaire survey, we identified three second order constructs as *Technical Vulnerabilities*, *Organizational Impact*, and *Threat Intelligence* that we hypothesized were correlated with our variable of interest: Cyber Security Awareness (CSA) (see Figure 1 below). This proposed research model would be the basis to test the various correlations associated with our dependent variable of interest using the SEM methodologies that we outline in this paper.

**Figure 1: Proposed Research Model**



**2. Proposing Hypotheses to Test Research Model Construct Associations**

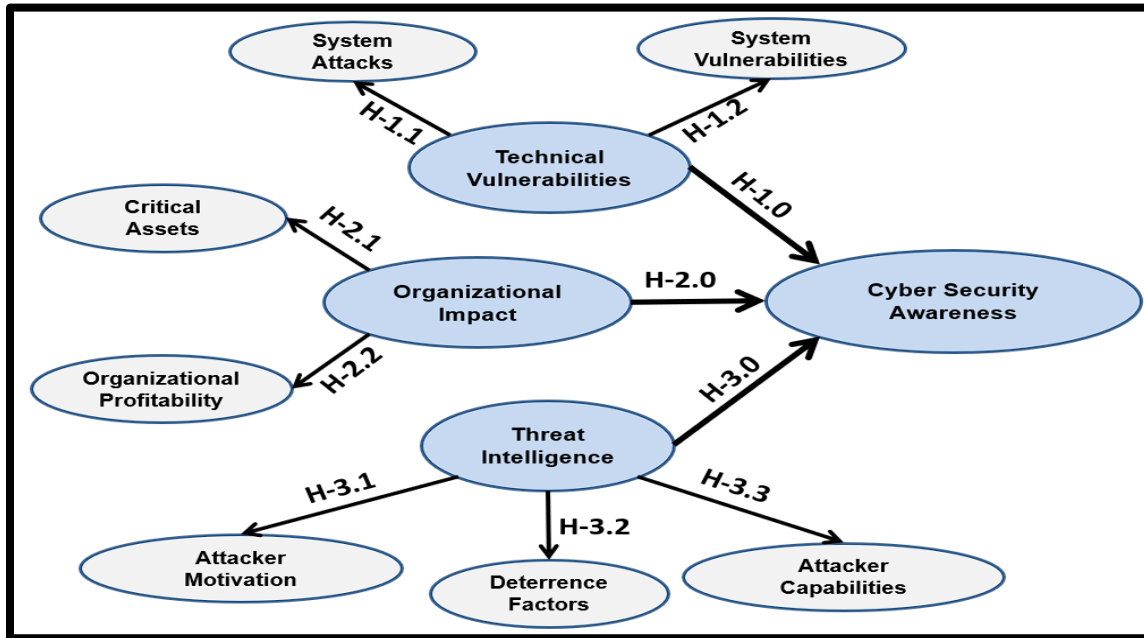
Once a research model with its proposed associated constructs is developed, related hypotheses should be developed to test the hypothesized associations among constructs. For the current research model, we developed a student survey questionnaire instrument to provide the input data to test the hypotheses related to our research model and their proposed related constructs. These survey input items, often termed “instrument variables” would provide the observable or empirical data to develop the “indicator constructs” used to develop both CFA models and the final SEM model.

The empirical data from our student questionnaire survey items identified the following seven indicator constructs: *System Attacks*, *System Vulnerabilities*, *Critical Assets*, *Organizational Profitability*, *Attacker Motivation*, *Deterrence Factors*, and *Attacker Capabilities*. Our research model proposed these seven indicator constructs could be possible determinants of the three second-order constructs in our proposed research model: *Technical Vulnerabilities*, *Organizational Impact* and *Threat Intelligence*. Based upon this research and the empirical data from our student survey items, we developed the following hypotheses to be tested via SEM methodology (Table 1). A graphical depiction of this research model and its related hypotheses to be tested is depicted in Figure 2.

**Table 1: Research Model Hypotheses to Test**

<i>Hi</i>	<i>Hypotheses to be Tested</i>
<b>H1.0</b>	<b><i>Technical Vulnerabilities of IT systems is positively associated with CSA</i></b>
H1.1	Knowledge of <i>system attacks</i> is positively associated with knowledge of technical vulnerabilities
H1.2	Knowledge of <i>system vulnerabilities</i> is positively associated with knowledge of technical vulnerabilities
<b>H2.0</b>	<b><i>Assessing the organizational impact of IT related issues is positively associated with CSA</i></b>
H2.1	Knowledge of <i>critical assets</i> is positively associated with knowledge of <i>organizational impact</i>
H2.2	Knowledge of <i>organizational profitability</i> is positively associated with knowledge of <i>organizational impact</i>
<b>H3.0</b>	<b><i>Threat Intelligence about threat actors is positively associated with CSA</i></b>
H3.1	Knowledge of <i>attacker motivation</i> is positively associated with knowledge of threat intelligence
H3.2	Knowledge of <i>deterrence factors</i> is positively associated with knowledge of threat intelligence
H3.3	Knowledge of <i>attacker capabilities</i> is positively associated with knowledge of threat intelligence

Figure 2: CSA Model with Hypotheses



### 3. Analyzing Survey Questionnaire Items: Identifying Indicator Constructs via Factor Analysis

CIS undergraduate students from a southwestern university completed a 52-item, 7-point Likert scale questionnaire which surveyed their knowledge of cyber threats, cyber attacks and cyber vulnerabilities relating to a TVA (Threat Vulnerability Asset) field study of various regional organizations. Responses to the survey questionnaire were voluntary with over 85% of the surveys returned for analysis generating a final sample size of 247 survey responses for our SEM illustration. Factor analysis determined whether the observed instrument variables grouped or converged upon their seven “indicator constructs” that were proposed to be associated with the three second order constructs of our CSA research model (*Technical Vulnerabilities*, *Organizational Impact* and *Threat Intelligence*).

Factor analysis, as a statistical analysis technique, is a critical component of SEM methodology and reveals how underlying observed instrument variables (questionnaire items) accurately converge together upon their respective constructs. Factor analysis also helps explain the covariation among observed variables and latent (unobserved) variables. Factor analysis develops the foundation for a SEM model by identifying related variables, patterns, and correlations among the research model constructs that may not have been initially considered.

The factor analysis process we used to develop our current SEM research model allowed for the removal of survey items that did not converge substantially upon their respective proposed constructs. This iterative process created a more viable research model that could test the proposed hypotheses in the research model. We utilized a popular student statistical software, SPSS (Statistical Package for the Social Sciences) for our SEM methodology factor analysis. SPSS provided a set of comprehensive tools for conducting exploratory factor analysis, the extraction of constructs, the estimation of factor loadings, and the analysis of the convergence of empirical data (i.e., the observed instrument variables) upon their proposed constructs).

The first step in employing factor analysis for SEM methodology involved analyzing the individual survey questionnaire items or observed instrument variables that formed the *indicator* constructs in the research model. We identified the indicator constructs in our research model by analyzing the survey questionnaire data set, addressing any missing values, then using the following SPSS software path: Analyze, Dimension Reduction, Factor to view several iterations of the factor analysis of the survey items from our database. For our initial factor analysis iterations, we requested a 7-factor CFA in SPSS to reflect the seven proposed indicator constructs hypothesized in our research model. SPSS provided various methods for the component rotation of factors (e.g., Varimax and Oblique rotation) which generated a clearer factor structure for identifying and confirming the indicator constructs in our research model.

During the analysis, we examined factor loadings and pattern matrices to assess the convergence of the observable survey items upon the seven proposed indicator constructs hypothesized in our study.

Several factor analysis iterations were conducted which removed individual survey items which did not load significantly on their proposed indicator constructs (i.e., factor loading < 0.50), or that cross-loaded upon other indicator constructs. These survey items were considered non-converging and were eliminated from the proposed SEM model to avoid measurement errors that could distort the interpretation of latent constructs which would preclude a more robust and valid SEM model (Dragan and Topolšek, 2014). The process of removing non-converging survey data items was iteratively performed until a "clean" and distinct factor analysis loading was achieved for all the indicator constructs in the research model. This iterative process was the basis for the inclusion of those particular individual survey items into both the CFA models and ultimately, the final SEM model (See Table 2), and confirmed the validity of the seven indicator constructs proposed in our initial Research Model. These indicator constructs were then analyzed for their association and correlation with their three second-order latent constructs: *Technical Vulnerabilities*, *Organizational Impact*, and *Threat Intelligence* of our research model.

**Table 2: Rotated Component Matrix: Factor Analysis of 7 Indicator Constructs**

	1	2	3	4	5	6	7
SA11	0.224	-0.083	<b>0.734</b>	0.138	0.114	0.048	0.159
SA12	0.384	0.094	<b>0.763</b>	0.095	0.028	-0.039	0.068
SA14	0.317	0.193	<b>0.753</b>	-0.073	0.149	0.003	0.028
SV15	<b>0.806</b>	0.219	0.339	-0.092	0.092	-0.104	0.065
SV16	<b>0.856</b>	0.051	0.172	0.098	0.192	-0.031	-0.038
SV17	<b>0.829</b>	0.184	0.334	0.040	0.151	-0.030	0.041
SV19	<b>0.698</b>	0.399	0.221	0.016	0.100	-0.065	0.058
CA22	0.169	0.146	0.261	0.124	<b>0.767</b>	-0.019	0.097
CA24	0.214	0.359	0.150	0.079	<b>0.630</b>	0.003	0.249
CA25	0.104	0.084	-0.037	0.159	<b>0.824</b>	0.030	-0.025
OP33	0.214	<b>0.854</b>	-0.036	0.111	0.199	0.003	0.122
OP34	0.125	<b>0.822</b>	0.010	0.130	0.119	0.007	0.146
OP35	0.203	<b>0.793</b>	0.182	0.129	0.104	-0.021	0.018
AM38	0.147	-0.021	-0.119	<b>0.812</b>	0.180	0.079	0.023
AM40	-0.006	0.249	0.143	<b>0.793</b>	0.073	0.004	0.253
AM42	-0.084	0.181	0.156	<b>0.833</b>	0.098	0.092	0.132
DF45	-0.050	-0.014	0.017	0.069	0.038	<b>0.932</b>	0.138
DF46	-0.089	-0.001	-0.008	0.078	-0.022	<b>0.934</b>	0.094
AC51	0.073	0.113	0.104	0.133	0.080	0.101	<b>0.900</b>
AC52	-0.014	0.145	0.102	0.198	0.092	0.160	<b>0.862</b>

SA= System Attacks; SV= System Vulnerabilities; CA = Critical Assets; OP=Organizational Profitability; AM= Attacker Motivation, DF=Deterrence Factors; AC=Attacker Capabilities.

### Convergent and Discriminant Validity

As indicated in Table 3, all individual survey items loaded or clustered appropriately upon their respective indicator constructs above the 0.50 threshold level indicating evidence of convergent validity (Fornell and Larcker, 1981; Hair, Anderson, Tatham, and Black, 1995). Table 3 also confirms that factor loadings were distinctly different from each other, indicating discriminant validity. Convergent validity for each construct in the research model was also indicated by AVE (average variance explained) which was above the 0.50 recommended threshold (Fornell and Larcker, 1981; Brunner, M., and Süß, H.-M., 2005). Internal consistency for individual survey items was assessed by computing composite reliability (CR) for each indicator construct. Composite reliability indicates that the shared variance among observed (empirical) variables should possess different factor loadings and error variances from each other (Fornell and Larcker, 1981).

As seen in Table 3, composite reliability scores for all constructs were above the recommended value of .70 indicating good internal consistency or inter-item reliability (Fornell and Larcker, 1981; Nunnally and Bernstein, 1994; MacKenzie, Podsakoff, and Podsakoff, 2011). Regarding discriminant validity, Table 3 indicates that factor loadings were distinctly different from each other and confirm that our questionnaire survey items scales exhibited good

psychometric properties (Nunnally and Bernstein, 1994) and that SEM methodology was appropriate for testing our research model depicted in Figure 1.

AMOS software (Analysis of a Moment Structures) was used for SEM, path analysis, and confirmatory factor analysis (Bryne, 2016; Dragan and Topolšek, 2014). Based upon the factor loadings by the individual instrument variables upon their respective indicator constructs from Table 3, (*System Attacks, System Vulnerabilities, Critical Assets, Organizational Profitability, Attacker Motivation, Deterrence Factors, and Attacker Capabilities*), Figure 3 illustrates the CFA models generated by AMOS software for the three second-order constructs: *Technical Vulnerabilities, Organizational Impact, and Threat intelligence*. All regression path coefficients from the indicator constructs to the second order constructs were significant at the .05 level or better.

**Table 3: Factor Loadings, Average Variance Explained, Composite Reliability of Indicator Constructs**

<i>Technical Vulnerabilities</i>					<i>Organizational Impact</i>				
	1	2	AVE	CR		1	2	AVE	CR
SA11	0.116	<b>0.859</b>			CA22	0.158	<b>0.843</b>		
SA12	0.388	<b>0.769</b>			CA24	0.407	<b>0.701</b>		
SA14	0.412	<b>0.695</b>	<b>.604</b>	<b>.820</b>	CA25	0.072	<b>0.807</b>	<b>.618</b>	<b>.828</b>
SV15	<b>0.845</b>	0.342			OP33	<b>0.899</b>	0.222		
SV16	<b>0.809</b>	0.246			OP34	<b>0.866</b>	0.130		
SV17	<b>0.854</b>	0.354			OP35	<b>0.810</b>	0.187	<b>.738</b>	<b>.894</b>
SV19	<b>0.831</b>	0.186	<b>.686</b>	<b>.902</b>					
<i>Threat Intelligence</i>									
	1	2	3	AVE	CR				
AM38	<b>0.820</b>	0.081	-0.011						
AM40	<b>0.822</b>	-0.004	0.313						
AM42	<b>0.856</b>	0.094	0.188	<b>.694</b>	<b>.872</b>				
DF45	0.074	<b>0.934</b>	0.132						
DF46	0.064	<b>0.938</b>	0.101	<b>.876</b>	<b>.934</b>				
AC51	0.133	0.090	<b>0.920</b>						
AC52	0.205	0.162	<b>0.886</b>	<b>.798</b>	<b>.888</b>				

AVE =Average Variance Explained; CR = Composite Reliability. Rotation: Varimax with Kaiser Normalization

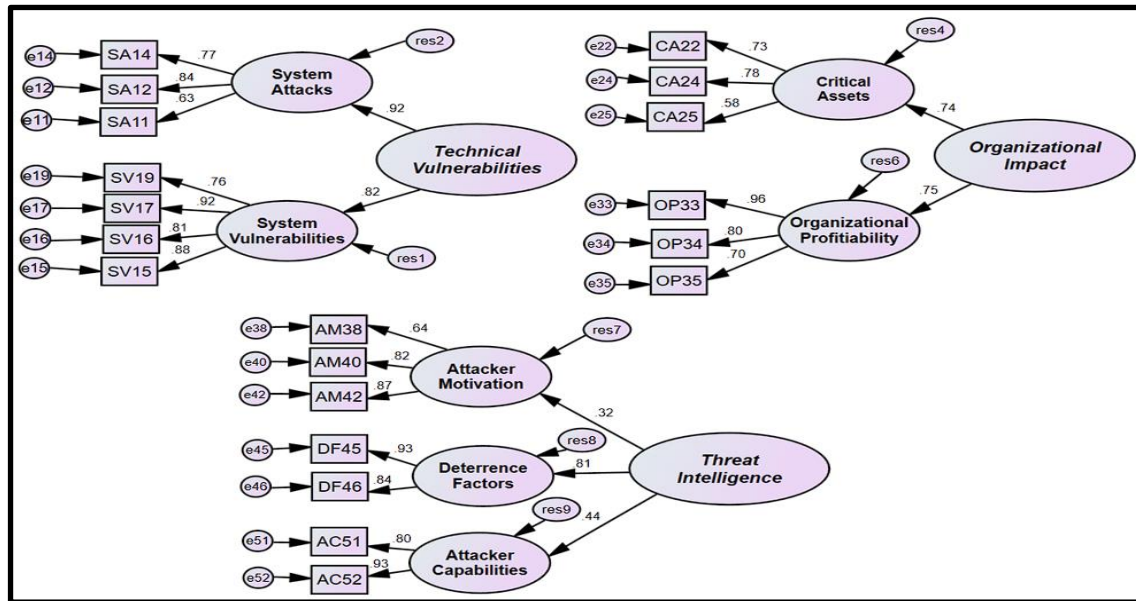
#### 4. Developing CFA Models

Developing robust CFA construct models before integrating them into a final SEM is vital. CFA allows researchers to evaluate the measurement properties of latent constructs, ensuring reliability and validity. By refining the composition of CFA models, potential issues with measurement variables will be resolved, thus improving the SEM measurement process. Integrating validated CFA construct models in a final SEM model enhances the overall credibility of the SEM model contributing to more structural relationships and a more holistic and innovative understanding of the phenomenon under study (Dragan and Topolšek, 2014; Anderson and Gerbing, 1988).

#### Related Fit Indices

When employing SEM methodology to test a research model, it is important for students and their supporting researchers to understand the importance of their CFA and SEM models displaying “good” fit indices. As indicated in Table 4, the following fit indices were reported:  $\chi^2$ ,  $p$  values, Normed Fit Index (NFI), Incremental Fit Index (IFI), Tucker-Lewis index (TLI), Comparative Fit Index (CFI), and the Root Mean Square Error of Approximation (RMSEA). The NFI, IFI, TLI and CFI indices compared the fit of the hypothesized model to a null model with adjustment for model complexity. RMSEA measures the discrepancy between the hypothesized model and the population covariance matrix (Dragan and Topolšek, 2014).

Figure 3: CFA Models: Technical Vulnerabilities, Organizational Impact, and Threat Intelligence



As shown in Table 4, CFA models indicated excellent fit with indices exceeding the 0.90 benchmark (Hair et al., 1995). RMSEA indices for all CFA models were at or below the recommended 0.10 threshold (Browne and Cudeck, 1993). Standardized residual covariances for all CFA models displayed no unusually large estimates indicating that the CFA models and their related indicator constructs were valid to include as second order constructs into the final CSA SEM model in this methodology.

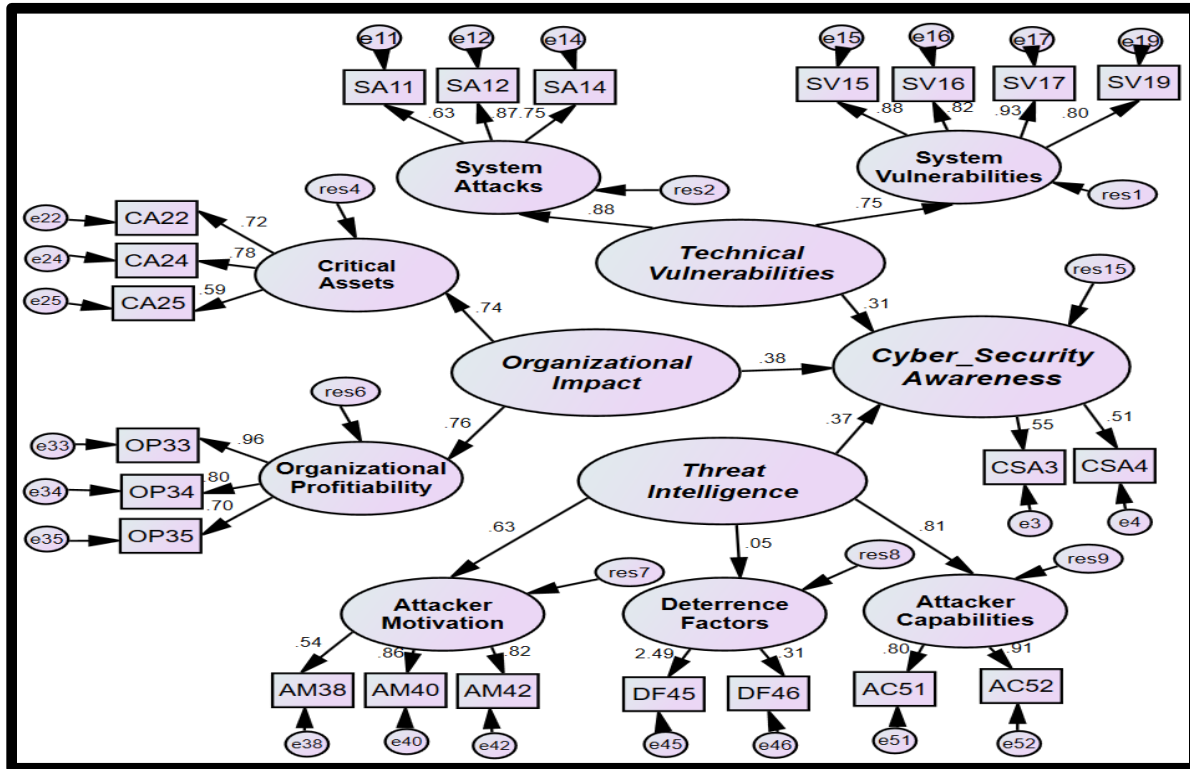
Table 4: Fit Statistics: Second Order CFA Models and Final ISA-ISS Risk Assessment Model

Fit Statistic	Technical Vulnerabilities	Organization Impact	Threat Intelligence	CSA Model
$\chi^2$	39.66	20.40	44.97	498.77
<i>p</i> -value	.001	.009	.001	.001
NFI	.963	.967	.942	.829
IFI	.975	.980	.958	.892
TLI	.944	.945	.907	.865
CFI	.974	.979	.957	.890
RMSEA	.091	.079	.100	.076

### 5. Integrating CFA models into the Final SEM Model

Based upon the CFA models generating good to excellent model fit indices for their respective 2<sup>nd</sup> order Constructs (*Technical Vulnerabilities*, *Organizational Impact* and *Threat Intelligence*), a final CSA SEM model was developed as shown in Figure 4. The final SEM research model generated excellent fit indices with path coefficients from all three second order constructs loading onto the dependent variable of interest, CSA at a  $p < .05$  significant level or better. Figure 5 illustrates the path coefficients and correlations of the research model hypotheses originally presented in Figure 2.

Figure 4: SEM with Indicator Constructs, Instrument Variables



## 6. Discussion of SEM: Did It Support the Research Hypotheses?

As shown in Figure 5, the path coefficient from *Technical Vulnerability* to CSA ( $\beta = .31$ ) was significant at the  $p < .01$  level. The path coefficients from *Organizational Impact* to CSA ( $\beta = .38$ ) and from *Threat Intelligence* to CSA ( $\beta = .37$ ) were both significant at the  $p < .01$  level. As summarized in Table 6, the results from this SEM methodology illustration supported all but one of the proposed hypotheses (H3.2). The final CSA SEM indicated that all indicator constructs (*System Vulnerabilities*, *System Attacks*, *Critical Assets*, *Organizational Profitability*, *Attacker Motivation*, and *Attacker Capabilities*, except *Deterrence Factors*) were positively associated with their respective 2<sup>nd</sup> order constructs at statistically significant levels. Specifically, the path coefficient for *Deterrence Factors* to *Threat Intelligence* indicated it had no significant coefficient correlations with *Threat Intelligence*.

In summary, the application of SEM methodology by students and their researchers outlined in this study provided valuable insights into the validation of a proposed research model and its related hypotheses. As depicted in Table 6, results obtained from the SEM methodology largely supported all the proposed hypotheses, with the exception of H3.2. The final CSA SEM revealed positive and statistically significant associations between all the indicator constructs and their respective 2<sup>nd</sup> order constructs. These findings highlight the importance of utilizing SEM by students and researchers, as SEM methodology provides a rigorous statistical framework to evaluate complex associations among variables and constructs. By confirming or refuting hypotheses, SEM methodology enhanced our understanding of the variables and constructs influencing CSA. Researchers can use these insights to inform policy decisions, develop and improve cyber security measures within organizations.



Figure 5: Final SEM and Related Constructs: CSA

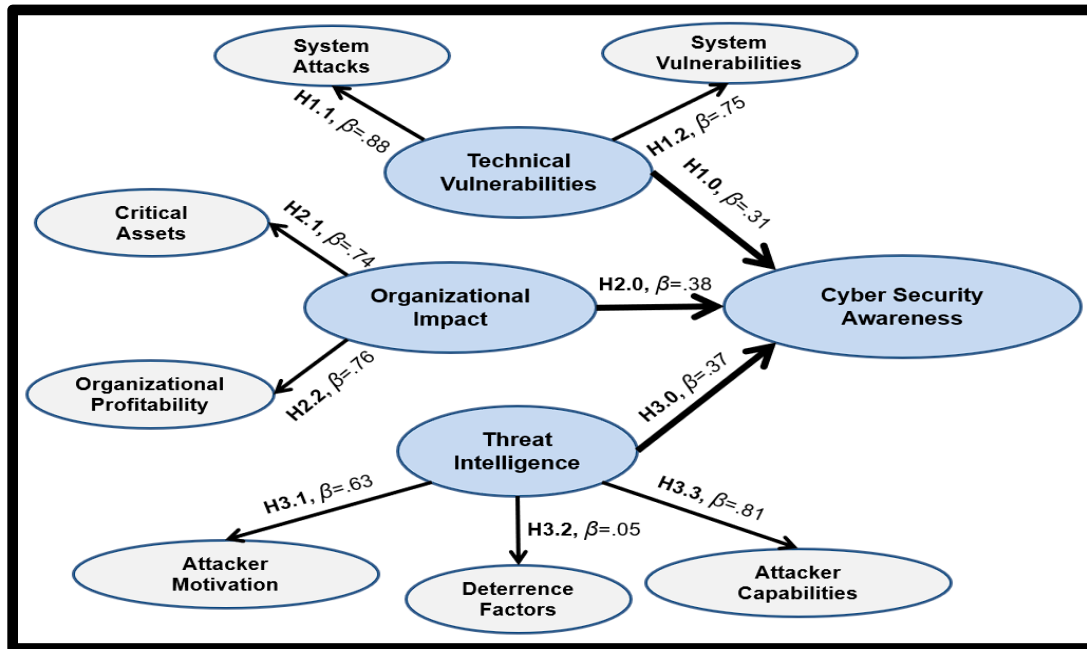


Table 5: Results of Research Model Hypotheses Tested

<i>H<sub>i</sub></i>	<i>Hypotheses to be Tested</i>	<b>Support Hypothesis?</b>	<b><math>\beta</math> Coefficients, <i>p</i> levels</b>
<b>H1.0</b>	<b>Technical Vulnerabilities of IT systems is positively associated with CSA</b>	Yes	$\beta = .31$ , $p < .01$
H1.1	Knowledge of <i>system attacks</i> is positively associated with knowledge of technical vulnerabilities	Yes	$\beta = .88$ , $p < .05$
H1.2	Knowledge of <i>system vulnerabilities</i> is positively associated with knowledge of technical vulnerabilities	Yes	$\beta = .75$ , $p < .01$
<b>H2.0</b>	<b>Assessing the <i>organizational impact</i> of IT related issues is positively associated with CSA</b>	Yes	$\beta = .38$ , $p < .01$
H2.1	Knowledge of <i>critical assets</i> is positively associated with knowledge of <i>organizational impact</i>	Yes	$\beta = .74$ , $p < .01$
H2.2	Knowledge of <i>organizational profitability</i> is positively associated with knowledge of <i>organizational impact</i>	Yes	$\beta = .76$ , $p < .05$
<b>H3.0</b>	<b>Threat Intelligence about threat actors is positively associated with CSA</b>	Yes	$\beta = .37$ , $p < .01$
H3.1	Knowledge of <i>attacker motivation</i> is positively associated with knowledge of threat intelligence	Yes	$\beta = .63$ , $p < .05$
H3.2	Knowledge of <i>deterrence factors</i> is positively associated with knowledge of threat intelligence	No	$\beta = .05$ , $p < .06$
H3.3	Knowledge of <i>attacker capabilities</i> is positively associated with knowledge of threat intelligence	Yes	$\beta = .81$ , $p < .01$

## CONCLUSION

This paper provided a comprehensive methodology for higher education students and researchers seeking to apply structural equation modeling (SEM) to test a proposed cyber security research model and its related hypotheses. However, it is important to appreciate that the use of SEM methodology extends beyond the realm of cyber security and may apply to a range of other domains and phenomena of interest. By visually representing statistical associations and correlations among proposed related variables and constructs via a single statistical estimation, SEM provides valuable insights and statistical support for a proposed research model and its related hypotheses to be tested. The authors encourage researchers and their students to consider using SEM methodology as a practical approach to gain a better understanding of the complex relationships between cyber threats, cyber attacks, and cyber vulnerabilities with cyber security awareness well as other latent constructs and observed variables of interest in their research endeavors.

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# Manuscript Guidelines, Submission and Review Process

## TOPIC AREAS (BUT NOT LIMITED TO THESE):

- Course design – current courses, new courses, new trends in course topics
- Course management – successful policies for attendance, homework, academic honesty ...
- Class material
  - Description and use of new cases or material
  - Lecture notes, particularly new and emerging topics not covered effectively in textbooks
  - Innovative class activities and action-learning – games, active learning, problem based
- Major or emphasis area program design that is new or innovative.
- Assessment – all aspects including AACSB and university level assessment strategies and programs
- Integration of programs or courses with other academic disciplines
- Internship programs
- Business partnerships
- Successful student job placement strategies
- Any topic that relates to higher education business education.

## SUBMISSION AND REVIEW PROCESS:

### Copyright

- Manuscripts submitted for publication should be original contributions and should not be under consideration with another journal.
- Authors submitting a manuscript for publication warrant that the work is not an infringement of any existing copyright, infringement of proprietary right, invasion of privacy, or libel and will indemnify, defend, and hold Elm Street Press harmless from any damages, expenses, and costs against any breach of such warranty.

### Prepare your manuscript

- See the Style Guideline page for specific instructions.
- Articles must make a contribution to business education innovation.
- Manuscripts should be limited to 8 to 10 pages or less, although longer will be accepted if warranted.
- Articles can be either regular research papers, or shorter notes that succinctly describe innovative classroom teaching methods or activities.
- Manuscripts should be completely finished documents ready for publication if accepted.
- Manuscripts must be in standard acceptable English grammatical construction.
- Manuscripts should be in MS Office Word format. Word 2007 files are acceptable, as are earlier versions of Word. If you are using a new version of Word after Word 2007, save in Word 2007 format.

### Submit your manuscript

- Manuscripts may not have been published previously or be under review with another journal.
- Submit the manuscript attached to an email to **submit@beijournal.com**
- We will respond that we have received the manuscript.
- Article submissions can be made at any time.
- Submission deadlines: September 15 for December issue, March 15 for June issue.

### **Manuscript review**

- The editor and reviewers will review your submission to determine if 1) the content makes a contribution to innovative business education, 2) is of the proper page length, 3) is written in proper grammatical English, and 4) is formatted ready for publication.
- Submissions not meeting any of these standards will be returned. You are invited to make revisions and resubmit.
- If the submission meets the standards, the manuscript will be sent to two reviewers who will read, evaluate and comment on your submission.
- The editor will evaluate the reviews and make the final decision. There are 3 possible outcomes:
  - Accept as is.
  - Accept with minor revisions.
  - Not accepted.
- Reviews will be returned promptly. Our commitment is to have a decision to you in less than two months.
- If your paper is not accepted, the evaluation may contain comments from reviewers. You are invited to rewrite and submit again.

### **If your paper is accepted**

- Minor revision suggestions will be transmitted back to you.
- Revise and send back as quickly as possible to meet printer deadlines.
- Upon final acceptance, we will bill you publication fees. See [www.beijournal.com](http://www.beijournal.com) for latest per page fees. Sole author fees are discounted.
- The fees include all costs of mailing a copy of the issue to each author via standard postal ground.
- Delivery to locations outside the continental US will cost an additional \$10 per author for 5 day delivery.
- Faster delivery methods are available for US and international delivery. Contact the editor for a specific pricing.
- All publication fees should be remitted within 10 business days of acceptance, if possible.
- If you decide not to publish your paper with BEI Journal after submitting payment, we will refund publication fees less \$200 to cover costs of review and processing.
- Cancellation cannot occur after the paper has been formatted into the final printer's file.

# Manuscript Style Guide and Example

An example is provided following these instructions.

This style guide represents style guidelines in effect for future issues, but always check for updates online.

Authors are responsible for checking for correct grammar, construction and spelling. Authors are also responsible for formatting pictures, tables, and figures such that a pdf black and white file sent to the publisher will reproduce in a readable manner.

## General Setup:

- All fonts other than exceptions noted below: Times New Roman. 10 point for text. Other sizes as noted below
- Margins: 1 inch on all sides of 8½x11 inch paper size.
- No headers or footers.
- Absolutely no footnotes or endnotes via footnote or endnote formatting. For footnotes or endnotes, place a number of the footnote in the proper location as a superscript. Then at the end of the paper or bottom of the page, add the footnote as text with a superscript number to correspond to that footnote.
- Page numbering bottom centered.
- No section breaks in the paper.
- No color, including url's. Format to black. No color in tables or figures. Use shading if necessary.
- All pages must be portrait orientation. Tables and figures in landscape orientations should be reformatted into portrait orientation.
- All paragraphs should be justified left and right, single spaced, in 10 point Times font, no indent on first line, 1 line between each heading and paragraph.
- One line between each paragraph.

## Titles, Authors, and Headings:

- **Title centered 14 point bold.** One line between title and author's name.
- Authors: centered, 12 point. Name, affiliation, state, country.
- One line space to **ABSTRACT** (title 10 point, bold, all capitalized, aligned left; text of abstract 10 point, no bold)
- After **ABSTRACT**, one line space, then **Keywords**. Followed by one line space to first major heading.
- **HEADINGS, MAJOR**, 10 point, bold, all capitalized, aligned left.  
The specific headlines will be based on the content of the paper, but major sections should at a minimum include an abstract, keywords, introduction, conclusion, and references.
- **Sub-headings:** 10 point, bold, first letter capitalized, no line to following paragraph. Align left.
- *Third level headings:* *Italic*, 10 point, first letter capitalized, no line to following paragraph. Align left.
- **Keywords:** heading: 10 point, bold, first letter capitalized, no line to following paragraph. Align left.  
Your list of keywords in 10 point, no bold.

## Tables, Figures and Graphs:

- All fonts 10 point.
- Numbered consecutively within each category. Table 1, Figure 1 etc.
- Title: 10 point, bold, left justify title, one space, then the table, figure, etc.
- Example: **Table 1: Statistical Analysis**

## References:

- APA format when citing in the text. For example (Smith, 2009).
- References section: 8 point font, first line left margin, continuation lines 0.25 inch indent. Justify left and right. No line spacing between references. List alphabetically by first author.
- Specific references: Last name, First initial, middle initial (and additional authors same style) (year of publication in parentheses). Title of article. *Journal or source in italics*. Volume and issue, page number range.
- Example: Clon, E. and Johanson, E. (2006). Sloppy Writing and Performance in Principles of Economics. *Educational Economics*. V. 14, No. 2, pp 211-233.
- For books: last name, first initial, middle initial (and additional authors same style) (year of publication in parentheses). *Title of book in italics*. Publisher information.
- Example: Houghton, P.M, and Houghton, T.J. (2009). *APA: The Easy Way!* Flint, MI: Baker College.

*Example (note that this example represents a change from previous style guides )*  
**Evidence to Support Sloppy Writing Leads to Sloppy Thinking**

Peter J. Billington, Colorado State University - Pueblo, Colorado, USA (12 point)  
Terri Dactil, High Plains University, Alberta, Canada

**ABSTRACT (10 point, bold, all capitalized, left justified)**

(text: 10 point Times font, no indent, justified, single space, 150 words maximum for the abstract)

The classic phrase “sloppy writing leads to sloppy thinking” has been used by many to make writers develop structured and clear writing. However, although many people do believe this phrase, no one has yet been able to prove that, in fact, sloppy writing leads to sloppy thinking. In this paper, we study the causal relationship between sloppy writing and sloppy thinking.

**Keywords:** sloppy writing, sloppy thinking (10 point, bold title, first letter capitalized, left justified).

**INTRODUCTION (10 point, bold, all capitalized, left justified).**

The classic phrase “sloppy writing leads to sloppy thinking” has been used by many to make writers develop structured and clear writing. However, since many people do believe this phrase, no one has yet been able to prove that in fact, sloppy writing leads to sloppy thinking. Is it possible that sloppy writing is done, even with good thinking. Or perhaps excellent writing is developed, even with sloppy thinking.

In this paper, we study the writing of 200 students that attempts to test the theory that sloppy writing leads to sloppy thinking.

**PREVIOUS RESEARCH**

The original phrase came into wide use around 2005 (Clon, 2006), who observed sloppy writing in economics classes. Sloppy writing was observed in other economics classes (Druden and Ellias, 2003).

**RESEARCH DESIGN**

Two hundred students in two business statistics sections during one semester were given assignments to write reports on statistical sampling results. The papers were graded on a “sloppiness” factor using...

**Data Collection** (Sub-heading, bold but not all caps, 10 point, aligned left, bold, no line after to paragraph)

The two hundred students were asked to write 2 short papers during the semester...

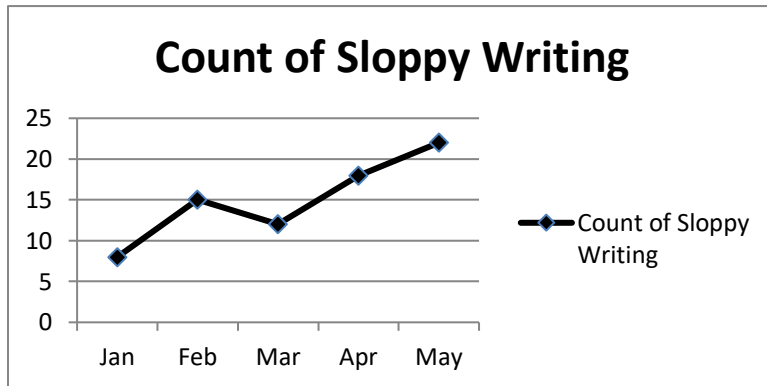
**Data Analysis**(Sub-heading, bold but not all caps, 10 point, aligned left, bold, no line after to paragraph)

The two hundred students were asked to write 2 short papers during the semester...

**DISCUSSION**

The resulting statistical analysis shows a significant correlation between sloppy writing and sloppy thinking. As noted below in Figure 1, the amount of sloppy writing increases over the course of the spring semester.

**Figure 1: Sloppy Writing During the Semester**



The count results were compiled and shown in Table 1 below.

**Table 1: Counts of Good and Sloppy Writing and Thinking (bold, 1 line after to table, left justify)**

	<b>Good Thinking</b>	<b>Sloppy Thinking</b>
<b>Good Writing</b>	5	22
<b>Sloppy Writing</b>	21	36

\*-Indicates significance at the 5% level)

As Table 1 shows conclusively, there is not much good writing nor good thinking going on.

**CONCLUSIONS**

The statistical analysis shows that there is a strong relation between sloppy writing and sloppy thinking, however, it is not clear which causes the other...

Future research will try to determine causality.

**REFERENCES** (title 10 point, all caps, bold, align left, one line to first reference)

(11line spacing) (All references 8 point, indent second line 0.25 inch, justify left and right)  
 Clon, E. (2006). Sloppy Writing and Performance in Principles of Economics. *Educational Economics*. V. 14, No. 2, pp 211-233.  
 Devad, S. and Flotz, J. Evaluation of Factors Influencing Student Class Writing and Performance. *American Journal of Farming Economics*. V. 78, Issue 3, pp 499-502.  
 Druden, G. and Ellias, L. (1995). *Principles of Economics*. New York: Irwin.

(short bio section optional, can run longer than these examples; removed before sent to reviewers)

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Endnote: (do not use word footnote or endnote formatting to accomplish this; see comments above)

Build 3 on 8-9-23