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- Title of the manuscript
- Each author's full name; position/title; institutional affiliation, including address, city, state, zip code; home, office, and cell phone numbers; and e-mail addresses (identify the main author who should receive all correspondence).
- Number of words in the article (including all parts–everything)
- Biographical paragraph (50-60 words) for each author
- Any acknowledgments or information about manuscript history (e.g., based on a conference presentation)

The second separate file attachment should be the manuscript file that begins with the title of the article, a 50-100 word abstract, 3-5 keywords or phrases describing the focus of the article, and the body of the manuscript. **Do not include any personal or institutional affiliation information in this file.**

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- Bold and center primary headings, with major words capitalized
- Bold and left-align secondary headings, with major words capitalized
- No footnotes or endnotes
- No page numbers or headers or footers

Tables and figures may have varying font sizes (but must adhere to APA Style). Include tables or figures formatted and placed correctly within the manuscript.

Include the References page at the end of the manuscript, followed by appendix information, if necessary.

All submissions will be reviewed by the editor and at least two reviewers, using a blind review process. Authors will receive feedback 6-8 weeks after the initial peer review. Manuscripts will be "accepted," "accepted with minor revisions," "possibly accepted after major revision and resubmission for further peer review," or "rejected."

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Decoding Public Perception: A Sentiment Analysis of the Top 10 Technology Trends That Will Shape the Next Decade

Benjamin Richardson, University of Georgia

Abstract

Sentiment analysis tools may be employed to evaluate aggregate trends in public perception among vast numbers of individuals by harnessing data publicly available on social media platforms. This study leverages such a tool to contribute to our understanding of the contemporary technological landscape by revealing sentiment surrounding the ten most prominent and transformational technology trends. The findings from this study provide critical contexts which may inform individuals, organizations, and educators of the current state of public opinion surrounding the trends of interest, which shifts in the technological landscape should be carefully monitored into the future, and what concepts and technologies may be worthwhile to adopt, implement, and teach.

Keywords: sentiment analysis, technology trends, future of work, social media, twitter, X

Introduction

As the number of available and impactful technologies continues to proliferate, organizations, educators, and individuals may be overwhelmed by the ever-increasing scope of information technologies and their directions in the marketplace. While the technological landscape evolves, technologies that were once widely used may continuously fade as new, more advanced and impactful systems become integrated into organizations and IT curriculums. The economic impact of focusing on technologies with limited capabilities and fading potential may be catastrophic, and prior research has shown that IT managers indicate that it is difficult to accurately forecast advances and trends in IT (Adomavicius, et al., 2008). As a result, understanding the future impact, potential profitability, and public sentiment of promising technologies is crucial for the success of organizations that aim to integrate these technologies into their operations, as well as for educational institutions that include them in their curricula.

This paper endeavors to tackle these issues through the utilization of an analytics-based approach and implementing natural language processing, in the form of a parsimonious rule-based model for sentiment analysis, to assess the public sentiment of the technologies that, in accordance with McKinsey and Company research, underlie the top ten trends in technology that will shape the forthcoming decade. The research assesses a representative sample of 335,586 randomly selected text-based posts extracted from X (recently rebranded from Twitter), encompassing a period from January 2019 through June 2022, or 3.5 years. Each post in the dataset pertains to one of the technologies of interest, and by grouping the posts by trend and technology, the public sentiment towards these subjects over time is analyzed.

Review of Sentiment Analysis

Over the past decade, social media platforms like X, Facebook, and Instagram have gained immense popularity, yielding a wealth of user data. Given their widespread use and low barriers to posting, these platforms offer timely and comprehensive information on user habits, tendencies, emotions, and preferences (Yue, et al., 2019). Numerous studies have employed data mining techniques, extracting text from user posts to analyze individual opinions on various entities (Gupta, Sharma, & Chennamaneni, 2016; Liu, 2010; Neri, et al., 2012).

Sentiment analysis, a subfield of natural language processing, machine learning, and computational linguistics (Yue, et al., 2019), focuses on extracting the author's attitude toward a specific topic. Sentiments are labeled as positive, neutral, or negative and are often reported as a composite score (Stieglitz & Dang-Xuan, 2013), an approach adopted in this paper.

While tools like Google Trends assess search volume (Choi, & Varian, 2012), sentiment analysis tools for social media provide unique insights from individual and aggregate user data. This allows assessment of not only the volume of posts on a topic but also public perceptions (El Barachi, AlKhatib, Mathew, & Oroumchian, 2021), positioning data scraping and sentiment analysis as invaluable tools for understanding public opinion.

This study utilizes X, formerly known as Twitter, as its primary data source. X is a prominent global social networking service. On July 23, 2023, the owner of the platform, Elon Musk, announced its rebranding from Twitter to X (Menn & Sotomayor, 2023). During the data collection period, the platform was still known as Twitter. Therefore, all mentions of "Twitter" in this paper should be understood as referring to X, and any references to "tweets" are synonymous with posts.

As a microblogging platform, X allows users to post 280-character messages called "tweets" or posts, follow others' activities, interact with messages, and track trending topics using hashtags. In the first quarter of 2019, Twitter had approximately 330 million monthly active users worldwide (Dixon, 2022). By December 2022, the platform, now rebranded as X, reported an increase to over 368 million monthly active users globally (Dixon, 2023). X is ideal for investigating public opinion as web 2.0 platforms foster naturalistic settings that generate free-flowing content, often unveiling unique insights beyond survey-based questionnaires (Makarem & Jae 2015; Ghose & Ipeirotis, 2009). Real-time posts with heightened anonymity minimize response bias (Peterson & Wilson, 1992; Gupta, et al., 2016), while sentiment analysis methods avoid recall biases typically linked to traditional quantitative and qualitative measurements (Gupta, et al., 2016; Rylander et al. 1995). Consequently, text-mining on social platforms, particularly X, presents a robust solution for market research and discerning raw, unbiased public sentiment.

The Top 10 Tech Trends

A comprehensive MIT study reveals that the pace of technological change and adoption varies across domains, with high-impact areas based on software and algorithms experiencing growth rates exceeding 40% annually (Murray, 2021). Rapidly advancing technologies dominate the market and become key players in the global landscape (Singh, Triulzi, & Magee, 2021). McKinsey & Company predicts the upcoming decade will witness more technological progress than the previous 100 years combined (Fleming, 2021). As these technologies evolve, it is essential to identify the most promising ones, their impact, and their acceptance and utilization by both industry and individuals.

McKinsey & Company's research identified the most transformative technology trends based on their applicability and impact across industries. Each trend received a momentum score derived from the growth rate of its underlying technologies, which was determined through an in-depth analysis of six proxy metrics: patent filings, research publications, online search trends, news mentions, private investment amounts, and the number of investing companies. These scores were compiled into a single composite score for each trend (McKinsey & Company, 2022). This study focuses on the technologies behind the top ten trends presented by McKinsey.

Trend 1: Next-level process automation and virtualization

Automation is projected to impact tasks across nearly all occupational groups (Muro, Maxim, & Whiton, 2019), with McKinsey & Company predicting that by 2025, more than 50 billion devices will connect to the Industrial Internet of Things (IIoT). Innovations in robotics, automation, 3D-printing, and other technologies, coupled with advancements in virtualization—the creation of virtual versions of resources, such as hardware, operating systems, or storage devices—will generate approximately 79.4 zettabytes of data annually. Both automation and virtualization carry significant implications for the future of work and organizational profitability, as they facilitate efficient resource allocation, streamlined processes, and cost reduction (West, 2018).

Trend 2: The future of connectivity

Trend three encompasses the advancement and integration of off-premise computing, commonly referred to as cloud and edge computing. These technologies empower organizations to mitigate substantial IT management costs, including computing, storage, and security, while enhancing scalability, speed, and resource optimization (Saini, Upadhyaya, & Khandelwal, 2019). McKinsey projects that by 2022, approximately 70% of organizations will adopt multi-cloud

management technologies, tools, and processes, characterizing distributed IT infrastructures. This shift towards distributed IT infrastructure will be mirrored in the growth of software sourced from cloud-service platforms, open repositories, and enterprise software-as-a-service (SaaS) providers, potentially rising from 23% today to 50% in 2025 or even 80% if adoption accelerates (Jagirdar, et al., 2013; The Top Technology Trends).

Trend 3: Distributed infrastructure

Trend three highlights the expansion and integration of off-premise computing, commonly known as cloud and edge computing. These technologies allow organizations to alleviate significant IT management costs, including computing, storage, and security, while enhancing scalability, speed, and resource optimization (Saini, Upadhyaya, & Khandelwal, 2019). McKinsey forecasts that by 2022, roughly 70% of organizations will adopt multi-cloud management technologies, tools, and processes, signifying a shift toward distributed IT infrastructures. This trend suggests that the proportion of software sourced from cloud-service platforms, open repositories, and enterprise software-as-a-service (SaaS) providers could increase from 23% today to nearly 50% by 2025, potentially reaching 80% if adoption accelerates (Jagirdar, et al., 2013; The Top Technology Trends).

Trend 4: Next-generation computing

Next-generation computing encompasses the rapid advancement of quantum computing and neuromorphic chips. Quantum computing utilizes quantum mechanics to solve computational problems with remarkable efficiency and capability (Li, et al., 2001). Neuromorphic chips, or application-specific integrated circuits (ASICs), address hardware limitations of traditional CPUs, enabling neuromorphic computing that emulates the human brain and nervous system (Greengard,

2020; Schemmel, 2022). McKinsey & Company asserts that next-generation computing could unlock unparalleled capabilities for businesses, accelerate chemical and pharmaceutical development through simulations, hasten autonomous vehicles with quantum AI, transform cybersecurity, reduce hardware costs in IT, expedite machine learning, and enhance searching of unstructured data sets (The Top Technology Trends).

Trend 5: Applied AI

Applied AI entails utilizing artificial intelligence methods to enhance systems across various domains, such as improving weather forecasting in meteorology, boosting warehouse logistics efficiency, enabling earlier disease diagnosis in medicine, or simplifying measurement methods and increasing instrument accuracy in the I&M domain (Khanafer & Shirmohammadi, 2020). Among the diverse technologies underpinning applied AI, McKinsey & Company highlights computer vision—facilitating machine recognition of images, videos, or text for informed decision-making—and natural language processing, which fosters human-like interactions between people and technologies (Birant, 2021; Meera & Geerthik, 2022). Researchers anticipate that, due to the accelerated development of AI technologies, artificial intelligence may soon match or even surpass human intelligence (Nowak, Lukowicz, & Horodecki, 2018).

Trend 6: The future of programming

The sixth trend pertains to the emergence of Software 2.0, wherein neural networks employing machine learning supplant developers in software creation (Dilhara, Ketkar, & Dig, 2021; McKinsey & Company). This paradigm shift promises innovative approaches to software development, reducing complexity, diminishing reliance on human programmers, and generating efficient, iterative code (Ratner, Hancock, & Ré, 2019; The Top Technology Trends). Software 2.0

is poised to significantly impact domains such as autonomous vehicles (Tian, et al., 2018), cybersecurity (Cai, 2020), drug discovery and development (Chen, et al., 2018), language translation (Nassif, et al., 2019), financial services (Roy, et al., 2018), and software engineering (Hellendoorn, 2018; Wan, 2021).

Trend 7: Trust architecture

In an era of escalating cyber threats targeting corporations, governments, and individuals, establishing a robust trust architecture, comprising solid cybersecurity defenses and distributed-ledger technologies like blockchain, is imperative. IBM reports that over 8.5 billion records were compromised in 2019, marking a 200% increase in exposed data year over year, with malicious activities predicted to rise absent a fortified cybersecurity infrastructure. Technologies such as blockchain—a decentralized, distributed digital ledger ensuring secure, immutable transactions and records (Monrat, Schelén, & Andersson, 2019; Sunyaev, 2020)—alongside "zero-trust security" strategies, are essential for building effective trust architectures (Rose, et al., 2020; Kerman, 2020).

Trend 8: The Bio Revolution

Driven by accelerated computing advancements, biological science breakthroughs, and AI maturation, biotechnology is catalyzing a novel wave of innovation known as the Bio Revolution. This movement encompasses diverse, emerging technologies such as biocomputing, molecular technologies, and biomachines (McKinsey & Company). Despite legitimate ethical considerations, the Bio Revolution holds the potential to transform not only healthcare but also agriculture, materials, informatics, and consumer goods sectors (Chui, Evers, & Zheng, 2020; Finbow, 2022).

Trend 9: Next-generation materials

The ninth trend highlights the emergence of next-generation materials, such as nanomaterials, and the consequent rise of nanotechnology. Contemporary nanoscience advancements stem from the ability to observe and manipulate structures at minuscule size and time scales, alongside the evolution of computational capabilities effective at small scales (Ramesh, 2009). Nanomaterials and nanotechnology, characterized by their lightweight, responsive, and occasionally programmable nature, pave the way for progress in manufacturing, information technology, aerospace, and medicine and pharmaceuticals (Emerich, & Thanos, 2003; Hulla, Sahu, & Hayes, 2015).

Trend 10: Future of clean technologies

The final trend addresses the burgeoning demand for renewable, clean-energy generation and eco-friendly technologies. Owing to escalating climate change risks (Thuiller, 2007), clean technologies aim to disrupt the energy sector and forge a responsible, sustainable future (Behera & Prasad, 2020). According to McKinsey & Company, potential solutions encompass smart-energy distribution systems, energy-storage systems, carbon-neutral energy generation, and fusion energy (The Top Technology Trends). A copious supply of green energy is crucial to sustaining the present exponential technological growth (Midilli, Dincer, & Ay, 2006).

Methodology

This study employs an inductive methodology that can be categorized into four core steps:

1. Identify the relevant, trend-specific hashtags prior to data collection
2. Leverage custom python code to scrape the text-based posts from Twitter

3. Employ a parsimonious rule-based model (VADER) to classify the sentiment polarity of each post

4. Perform exploratory analysis to evaluate public sentiment towards each trend.

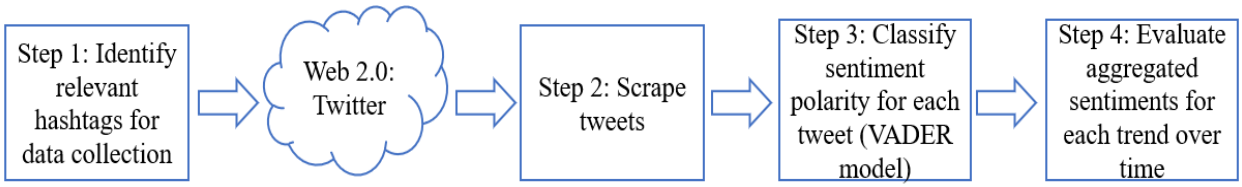

Figure 1: Sentiment scraping research framework

Step 1

Prior to data collection, it was essential to delineate specific technologies within the ten tech trends under investigation, with the aim of accurately evaluating the associated sentiment. As each trend constituted an expansive subject, the study focused on targeted hashtags to refine the returned results. For instance, upon scrutinizing posts with #programming for Trend 6 (the future of programming), the sentiment analysis yielded vague outcomes bereft of substantive insights. By concentrating on at least one fundamental technology within each trend, the sentiment analysis became more discernible, fostering the extraction of precise insights.

Nevertheless, certain technologies underpinning individual trends failed to elicit ample discourse on X, resulting in their exclusion subsequent to an initial data extraction. For example, the study initially endeavored to analyze Software 2.0 for Trend 6 but discovered a meager 65 posts (including 37 in English) spanning a 3.5-year period. Consequently, topics with fewer than 1,000 English posts were omitted. The pertinent hashtags for each trend are enumerated in Table 1.

Trend	Technologies of Interest
Trend 1: Next-level process automation and virtualization	#Robotics, #3D-printing
Trend 2: The future of connectivity	#5G, #IoT.
Trend 3: Distributed infrastructure	#CloudComputing
Trend 4: Next-generation computing	#QuantumComputing, #NeuromorphicComputing
Trend 5: Applied AI	#AppliedAI, #ComputerVision, #NaturalLanguageProcessing
Trend 6: The future of programming	#MachineLearning
Trend 7: Trust architecture	#Blockchain, #Cybersecurity
Trend 8: The Bio Revolution	#BioRevolution/#BioComputing, #BioEngineering
Trend 9: Next-generation materials	#Nanomaterials, #Nanotechnology
Trend 10: Future of clean technologies	#CleanTech

Table 1: Technology trends and their associated underlying technologies

Step 2

To scrape the posts associated with the chosen topics an iterative python script was developed. The code leverages several python packages and libraries including snscrape which serves as a non-API scraper for social networking services and enables the scraping of user profiles, hashtags, searches, and relevant posts based on specific topics (Snscrape). The script gathered up to a maximum 25 posts each day, for each topic, over the 3.5-year period from January 2019 through

June 2022. Any posts associated with the topic were then compiled into a dataframe that was then output to a database for analysis.

Step 3

A crucial aspect of the script entailed classifying the sentiment associated with each post, as obtaining precise sentiment scores was vital for the study's actionability. Numerous scoring algorithms and machine learning pipelines were evaluated to identify and implement the most accurate model. This research utilizes the Valence Aware Dictionary for sEntiment Reasoning (VADER), a rule-based model specifically designed for general sentiment analysis. Given its exceptional performance in the social media domain, VADER is uniquely suited for this study. VADER's correlation coefficient ($r = 0.881$) is comparable to individual human raters ($r = 0.888$) in matching ground truth sentiment intensity, and VADER ($F1 = 0.96$) even surpasses individual human raters ($F1 = 0.84$) in accurately classifying post sentiment into positive, neutral, or negative categories (Hutto & Gilbert, 2014).

Each post extracted from X was processed through the VADER model, yielding negativity, positivity, and neutrality scores on a scale from zero to one. These scores were then combined into a compound score ranging from -1 (very negative), 0 (neutral), to 1 (very positive). Table 2 exemplifies this scoring model, illustrating a post with varying degrees of negativity, neutrality, and positivity, culminating in a marginally negative sentiment score.

Example Post Text	**Negative**	**Neutral**	**Positive**	**Compound**
Five things that shook our world of #healthcare #3dprinting #bioprinting #AnnualReview of #news, gossips, wins and losses	0.255	0.598	0.147	-0.1779

Table 2: Example of a post and its associated sentiment scores

Step 4

The final methodological step was taking the scored topics and aggregating them over time to identify key patterns and insights into the tech trends. The quantity of posts associated with each trend, the general sentiment, and the sentiment over time was evaluated.

Findings

Upon analyzing and aggregating the 355,586 posts scraped from X over the 3.5-year period, several prominent patterns that may have significant implications for our understanding of the technology trends of interest were discovered. The posts were first aggregated by the technologies underlying the trends and took counts of the number of posts associated with each trend. That number was then averaged by the number of terms searched for each topic. The resulting totals, as seen in *Figure 2*, provide insights into the prevalence, popularity, and intensity of the conversation surrounding each technological trend.

With a distribution of posts per topic ranging from 29,878 total posts to a minimum of 10,313, it's clear that certain topics have historically generated far more discussion on the forum than others. Because the code gathered up to 25 posts per day, for each day over the 3.5-year period from January 2019 through June 2022, the maximum number of total posts that any given topic could have generated over that time period is approximately 31,938. Trends 1, 3, 6, 7, and 10 all fall far above the average of 22,141 posts, suggesting that the technologies underlying those tech trends are, on average, generating significantly more discussion on X. The comparable prevalence of these 5 topics not only suggests that these technologies are consistently talked about, but that they are also prevalent parts of the current technological landscape. For example, the discussion surrounding Trend 1 - Automation and Virtualization, is a conversation that has been consistently discussed over

the course of many years. The underlying technologies of robotics and 3D printing have been circulated and embraced by the general public. Their applications, benefits, and problems of the past, as well as their potential for future applications of such technologies, generate a substantial amount of dialogue.

However, this pattern is not consistent among all of the tech trends. Exactly half of the topics (i.e., 2, 4, 5, 8, & 9) fall far below the average of approximately 22,000 posts. For example, Trend 8 - The Bio Revolution, has not been discussed to a large degree on X's public forum. This is evident as the underlying topics of Bio Revolution/Biocomputing and Bioengineering do not generate much discussion, and on average, generate only 10,313 posts. This comes out to an average of approximately 8 posts on each topic per day. Such a limited discussion on the web is likely due to a variety of reasons: bioengineering concepts may not be employed by a substantial number of users, bioengineering may not be a topic of interest for the majority of companies and individuals, the future applications of bioengineering may not yet be obvious or compelling, and there is likely very little news coverage of the topic being circulated. Although this metric may indicate the degree to which the conversation surrounding each trend is perpetuated, it does not predict its future potential to shape society or how the public feels about each topic. Sentiment analysis may be uniquely positioned to help achieve this purpose.

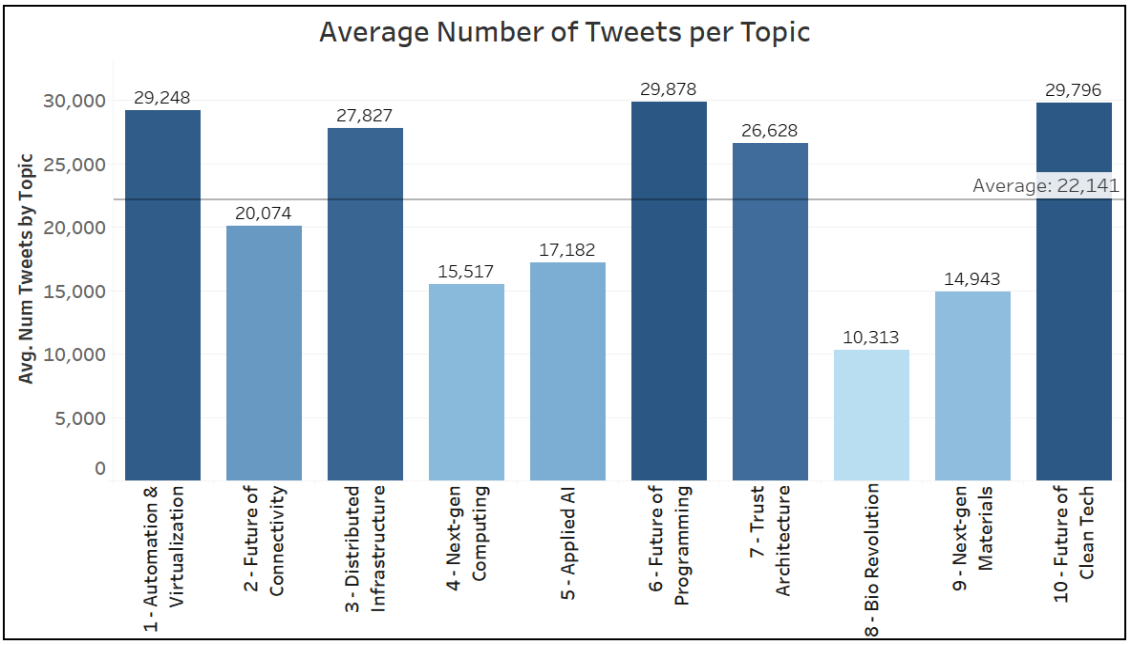

Figure 2: Average number of tweets (posts) for each topic within each of the ten trends

Upon aggregating the composite sentiment scores for all of the posts associated with each trend, it becomes evident that each score has a slightly positive sentiment score. With a possible range of -1 (very negative) to 1 (very positive), this pattern is apparent in the overall average score of 0.26 (see *Figure 3*). This suggests that generally, the public is subtly optimistic about the technologies behind each of the top ten technology trends. The perceived level of subtle optimism is consistent across all of the trends (with the exception of two) which is exhibited in a range of sentiment scores varying from 0.19 to 0.27. The two exceptions are Trend 7 - Trust Architecture, at 0.35, and Trend 10 - Future of Clean Tech, at 0.41. Both of these tech trends exhibit heightened levels of positive sentiment not currently present among the other trends. Such a difference suggests that in the public's view, the discussion surrounding both trust architecture and clean technology is noticeably constructive, hopeful, and efficacious. The other eight trends exhibit positive aspects, but

their levels of optimism are less pronounced, indicating that individual experiences with the underlying technologies are inconsistent and subject to fluctuations.

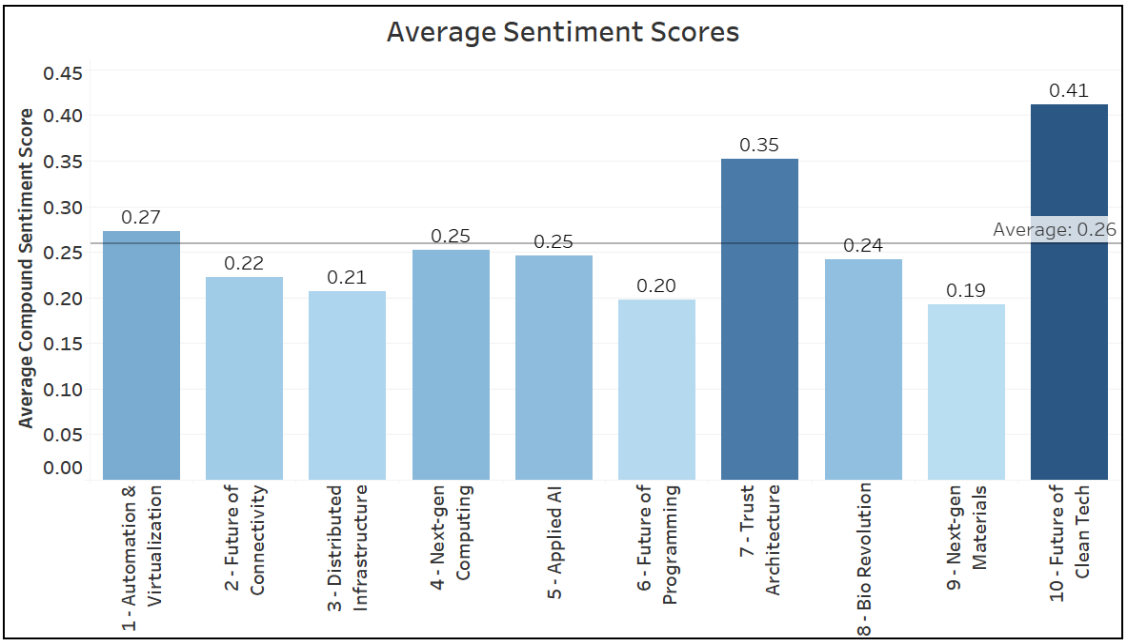

Figure 3: Average sentiment score for each tech trend

While evaluating the overall sentiment for each trend is insightful, further patterns can be discerned by observing the fluctuations in sentiment over time. *Figure 4* provides a clear visualization of these patterns over time for the four most volatile trends—Trend 2 at +0.05, Trend 8 at -0.07, Trend 7 at +0.23, and Trend 10 at +0.05. These differences show that the aggregated sentiment surrounding the individual tech trends may change over time with both positive and negative effects. For example, Trend 8 - the Bio Revolution has seen a slight reduction in positive sentiment since the beginning of 2019. Although a difference of -0.07 is minute, the overall change is significant as it may reflect a diminished sense of trust, disillusionment with the underlying technologies, or a sense of confusion associated with the topic. Contrastingly, Trend 7 - Trust Architecture, reflects a significant jump in sentiment score from 0.27 in 2019 to 0.50 in June of

2022. This change can be attributed to increases in sentiment associated with the underlying technologies, namely blockchain and applications of cybersecurity. As user perceptions of blockchain evolve over time, it's evident that blockchain and cybersecurity concepts are becoming increasingly understood and leveraged.

The remaining 6 trends not included in *Figure 4* show very little variation over time, averaging less than 0.02 in sentiment score divergence over the 3.5-year period. This level of consistency suggests that many of the technologies underlying the trends are not very volatile in terms of their acceptance and public perception. This is not surprising as many of such technologies, such as machine learning, robotics, and 3D printing, despite being transformative, are not novel, and as a result the sentiment towards them has not significantly changed over time.

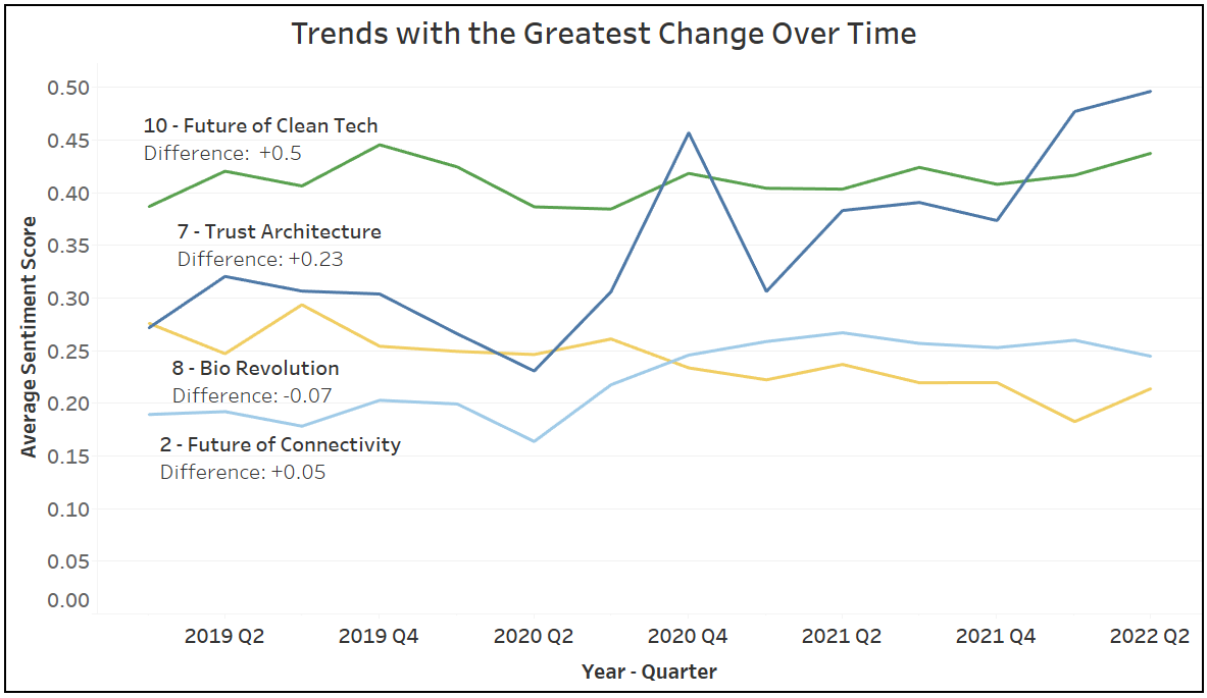

Figure 4: Top four trends with the greatest change in sentiment score over time

Discussion

This study aimed to employ a sentiment analysis tool to appraise the prevailing attitudes towards the ten most pivotal technology trends. This approach facilitated the discernment of key patterns, offering unique insights into public perception and a comprehensive understanding of the trends and their constituent technologies. The analysis revealed that the sentiment towards several trends not only varies among them but also evolves over time, suggesting that attitudes towards individual tech trends are contingent upon diverse external factors. Subsequent research may integrate multiple data sources and explore the rationale behind the disparities in sentiment associated with distinct trends and technologies within the context of social media posts.

There are several significant findings from the analysis that are worth noting. First, not all trends generate the same amount of discussion online. This is evident by the disparity between the various trends (see *Figure 2*). Five of the topics that fall above the average of about 22,000 posts are widely discussed daily. This suggests that these tech trends are already well underway to transforming society to various extents in their respective spheres of influence. Their roles in industry are likely to continue to expand as individual users, organizations, and educators leverage existing documentation and precedent to better understand and apply the underlying technologies in new and transformative ways.

However, this does not necessarily mean that the remaining five trends that have historically failed to gain traction on online forums are not yet transformative. It is likely, however, that such trends and their underlying technologies are not yet widely viewed as playing major roles in their respective industries, or perhaps are simply not yet interesting enough to users and companies to generate substantial traction online. It can be expected that in the coming years, trends 2, 4, 5, 8, and

9 will steadily grow in popularity as their roles and applications proliferate beyond their current state.

Second, the average composite sentiment scores paint a distinctive image of the tech trends. Only Trend 7 - Trust Architecture (0.35) and Trend 10 - The Future of Clean Tech (0.41) have average sentiment scores above 0.3 (see *Figure 3*). Such a finding suggests that these two trends are the only trends out of the ten that have consistently been discussed on Twitter in a remarkably positive light. As the public continues to view these two trends in such a way, it can be expected that the trends will continue to gain traction and build upon previous positive sentiment to fuel future transformative technological solutions.

The remaining eight tech trends, which all fall within a 0.08-point range of 0.19-0.27 all also have generally positive sentiment scores, however the strength of those scores is not as pronounced. This is to be expected as tech trends such as these with vast amounts of potential are still being explored, critiqued, and evaluated. Such exploration often results in negative experiences at both the individual and corporate level. But such a struggle does not necessarily negate the future potential that the underlying technologies of those eight trends have to transform the modern technological landscape.

Third, the longitudinal analysis of composite sentiment for various technology trends offers valuable insights for a range of stakeholders, including organizations, researchers, and educators (see Figure 4). By examining how these trends have been historically perceived and comparing that data to current perceptions, we gain a nuanced understanding of the likely trajectory of these technologies. For example, the sentiment towards Trend 7 - Trust Architecture, has shown a

consistent positive uptick over a 3.5-year period. In contrast, sentiment for Trend 8 - The Bio Revolution, has gradually declined.

While this study does not aim to make long-term predictions, the observed trends can serve as a strategic guide for stakeholders. Organizations may use this data to make informed decisions about which technologies to invest in or integrate into their existing systems. Researchers could find these trends useful for identifying areas that warrant further investigation, potentially leading to breakthroughs or refinements in the technology. Educators, particularly those in universities and technical programs, can use these insights to tailor their curricula, focusing on technologies that are gaining positive sentiment and are likely to be influential in the future.

Conclusion

This study offers a comprehensive analysis of the prevailing sentiment surrounding the ten most impactful and transformative technology trends, thereby deepening our understanding of the current technological landscape. By employing rigorous methodologies to gauge public and expert sentiment, the research provides a nuanced view of how these trends are perceived, both positively and negatively. This not only sheds light on the technologies that are currently resonating well within various communities but also highlights those that may be facing skepticism or challenges. The findings serve as a valuable resource for identifying which technologies are gaining traction and are poised for future growth, as well as those that may require further refinement or risk mitigation. In essence, the study acts as a barometer for the state of technological innovation, offering stakeholders a clearer picture of where the industry is headed.

Opportunities for further research in this domain may include pairing the data available from X with data from one or more other data sources, including financial services, patent filings,

corporate investments, Google search trends, and other social media platforms. While this study is limited to the patterns revealed from performing sentiment analysis on Twitter posts, the inclusion of multiple data sources would help provide a more holistic view of the marketplace and foster increased understanding of how these core technology trends have been perceived, how they are currently understood and employed, and to what extent such technologies will play a transformative role in the future.

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The MOS Certification – A Historical Perspective with a Look to the Future

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Abstract

With the increased demands from industry for students to have credentials in software packages, this study looked at the pass rate and scores of students on the Microsoft Office Specialist (MOS) Word 2019 Associate (MO-100) exam. The study suggests questions such as: Is the School of Business's Introduction to Information Technology course experiencing a successful pass rate? What has been the trend of pass rates since 2019? and What changes might be needed to the course once this data is reviewed? This study proposed a look at some of the historical data collected about those scores. Specifically, the school terms of 2019-2020, 2020-2021, and 2021-2022 were analyzed, recorded, and described. Data from a mixture of 778 online and face-to-face students was collected over seven semesters and reported in aggregate form using tables.

Completed research will help the School of Business determine if the current course should remain as is, become more rigorous to allow for both the MOS Word Associate (MO-100) and Expert (MO-101) exams in one course, or if a second course should be developed to add an additional certification. Recommendations and changes will be made to allow for continuous improvement of curriculum for future semesters, to keep up with current industry needs, and to help experience higher rates of student employment upon graduation.

Keywords: *Microsoft Certification Exam, Microsoft Office Specialist, MOS Word*

Introduction

> *Students who earn MOS certifications have been shown to* ***earn higher GPAs, graduate at a higher rate, and get higher-paying jobs****. The Microsoft Office Specialist Program also helps educational institutions raise the bar on their performance*
> (Microsoft Office Specialist Program--Success Stories, 2022)

Business and industry have made certification an important qualification for employment, where often an employee is required to have a certification at the time of hire, or employees must obtain certification upon hire (How to Show Proficiency in Microsoft Office on a Resume, 2023); (Schlichting & Mason, 2004). IT hiring managers have used certification as a differentiator between job candidates with similar levels of experience, and salary surveys have shown that certified employees are compensated at a higher salary than non-certified employees are compensated (Hunsinger & Smith, 2008).

A great need exists for certified Information Technology professionals in the workplace, and industry employers are actively seeking workers with such certifications. An AACSB accredited School of Business (SOB) within the College of Business & Technology (COBT) at a regional, four-year university in Louisiana provides undergraduate degrees in Accounting, Business Administration, and Computer Information Systems. As the SOB prepares students for employment following graduation, it is increasingly important for the institution to provide adequate and effective training through the coursework offered in their programs and to continuously search for additional ways to make their graduates more attractive to employers.

Universities and their faculty are often tasked with finding ways to increase their students' employability upon graduation. Employment upon graduation is a statistic recorded and maintained to gauge the success of a higher education institution, and for accreditation purposes in business programs. Industry's need for certifications coupled with the university's goal of high employment rates upon graduation can be a win-win for both sides.

The SOB's advisory council of industry partners and potential employers for their students have expressed the desire to hire graduates with certifications and micro-credentials, including the Microsoft Office suite of products. Therefore, offering opportunities to obtain such provides students with a credential to add to their resume when seeking employment (Tarver et al., 2009).

School of Business graduates who pass the MOS exam with a score of 700 or higher can digitally broadcast the accomplishment with a Microsoft badge (Microsoft, 2023). This tells employers what the candidate has achieved and provides them with verifiable data to check the skills they have learned, giving them instant credibility. The BUAD 1800 – Introduction to Information Technology course is the first certification class taken by students in the SOB's business degree program. These students currently take the MOS Word Associate (MO-100) exam only in the course. This research addresses a possible means to increase students' probability of employment upon graduation by providing additional opportunities for certifications and micro-credentialing in the program, more specifically the BUAD 1800 course, with the addition of the MOS Word Expert (MO-101) exam.

Problem

The SOB faculty have been giving the Microsoft Office Specialist (MOS) Word Associate (MO-100) exam in different classes since 2002 (Autry et al., 2004). The exam has been the required final exam for the Introduction to Information Technology (BUAD 1800) course since 2015.

Though passing the exam is not mandatory, taking the exam is required for students to pass the class. Faculty recently attended research conferences and learned that other universities were requiring both the MOS Associate (MO-100) and Expert (MO-101) exams during the same semester, giving one as the mid-term and one as the final exam. This research originated to determine whether the SOB's student population could also handle the increased requirement of an additional certification exam for the BUAD 1800 course at the end of a 16-week semester.

BUAD 1800 was specifically designed to prepare students for the MOS Word Associate (MO-100) exam. This exam changes every few years as Microsoft updates its programs. Records have been kept of students' attempts and scores since the inception of the class. The first few years of historical data collected is from the MOS Word 2016 Associate exams. This study looks only at the student scores from the updated MOS Word 2019 Associate (MO-100) exams. Specifically, the school terms of 2019-2020, 2020-2021, and 2021-2022 were analyzed. Future students in this class will take the new updated version of the Associate exam, MOS Word 365, which was released in Summer 2023.

With the increased demands from industry for students to have credentials in software packages, this study looked at the pass rate and scores on the MOS Word 2019 Associate (MO-100) exam. The data will be analyzed to determine if there is a need to strengthen the requirements for the course to allow students the opportunity to achieve both the Word Associate (MO-100) and Expert (MO-101) certification in this one course or add a second course. The study suggests questions such as: Is the SOB's Introduction to Information Technology course experiencing a successful pass rate? What has been the trend of pass rates since 2019? What, if any, changes might be needed to the course once this data is reviewed? and What is the likelihood of students also passing the MOS Word Expert (MO-101) exam at the end of the semester?

The purpose of this study was to try to answer these and other related questions by reviewing the test scores from both face-to-face and online sections of seven semesters of the BUAD 1800 course. Objectives were: (1) to gather and report information about the students' scores on the MOS Word 2019 Associate (MO-100) exams, (2) to prepare a graphic showing any trends, and finally, (3) to determine if the faculty should continue teaching the course as is or if a possible change of curriculum might be needed in the future.

Background

The SOB requires that all enrolled students in BUAD 1800 - Introduction to Information Technology must take the MOS Word Associate (MO-100) exam as the final exam in the class. The entire class covering a semester is used to prepare the students for taking the certification exam at the end. The first six chapters of the *Microsoft Office 365 Comprehensive Word 2019 Exploring Series* by Poatsy is the required textbook for the class, published by Pearson Education. The students use the *MyLabIT* program which is part of the Pearson platform that comes with the textbook for completed classwork. Students also use the additional test preparation tool GMetrix as practice for the final exam. Students were not all taught by the same instructor each semester.

Instrument

The instrument used for the study was the Microsoft Office Word 2019 Associate (MO-100) exam and Microsoft Office Word Expert (MO-101) exam, offered through Certiport. Certiport is the leading provider of certification exam delivery with more than three million tests given annually by more than 14,000 Certiport Authorized Testing Centers (CATC) in 148 countries around the world (Microsoft, 2023). The SOB has been deemed a CATC that is allowed by the company to administer Certiport exams, with certain professors being deemed qualified proctors. Administration requires advanced setup and configuration of live-in-the-application (LITA) software to be

downloaded on all computers for students taking the exam face-to-face in the classroom. Online students took their exams from home remotely using the Certiport proctoring website with faculty watching the students live. Some students also took the exam at private certified testing centers they located themselves.

Population

The population for the study was a sample of students enrolled during the 2019-2020, 2020-2021, and 2021-2022 school years in 25 sections of Introduction to Information Technology (BUAD 1800) courses. This course is the first required core course for the undergraduate degrees offered in the School of Business. There were seven semesters of the BUAD 1800 course analyzed including Fall 2019, Spring 2020, Fall 2020, Spring 2021, Fall 2021, Spring 2022, and Fall 2022. The total population reviewed from these semesters was 778 students.

The 25 sections used for this study were taught by multiple instructors in both online and face-to-face settings. The students take this course during their first semester of college, with 98% of the population being entering freshmen from high school. Additional demographic information about each student was also gathered such as their name, major, and gender. That information is not included in the data studied here.

Methodology and Data Analysis

In this exploratory study, the data was collected by the instructors of the twenty-five sections of the course with a total population of 778 students. The students' scores were a part of the historical data kept for each of the sections. Professors collected and reviewed all the scores from the MOS Word 2019 Associate (MO-100) exam obtained at the end of each semester. During the Fall 2022 semester, professors also administered a small sample of MOS Word 2019 Expert (MO-101) exams to students with a 900 or greater score on the MOS Word 2019 Associate (MO-100) exam.

The Word Expert (MO-101) exam was given at the end of the Fall 2022 semester after students first completed the Associate (MO-100) exam.

Records were studied, recorded, and analyzed from this historical data. The study was completed during the Spring 2023 semester. Some demographic data on each student was also collected but not reported. The scores were downloaded into an Excel spreadsheet for analysis. For this exploratory study, the findings were reported using descriptive statistics in the form of tables.

The MOS Word 2019 Associate (MO-100) exam covers the basic tasks needed to use the Word 2019 computer application. A perfect score on the exam is 1000. A passing score is 700 or above. The goal is to have all students in the BUAD 1800 course pass the exam and receive certification in Microsoft Word. Table 1: Descriptive Statistics shows the average (mean) points scored out of 1000 for all students who completed the exam during the semesters reviewed for this study. The table shows the number of students participating each semester and the standard deviation each semester. The total number of students participating in this study was 778. The number of students tested each semester ranged from 83 to 147. Fall semesters have the largest number of students as most incoming freshmen are required to take this course during the first semester of enrollment.

Table 1

Descriptive Statistics by Semester

Semester	n	Mean	SD
Fall 2019	114	754	164.5
Spring 2020	93	744	193.7
Fall 2020	112	741	185.8
Spring 2021	83	665	208.2

Fall 2021	134	723	211.1
Spring 2022	95	725	177
Fall 2022	147	750	174.6

Standard deviation scores ranged from 164.5 to 211.1, with the smallest variation during the Fall 2019 semester and the largest variation happening during the Spring 2021 semester. The scores ranged from 665.3 to 753.9 a variation of 88.6 points which is approximately a 13% difference. The data shows consistency among the seven semesters, except for Spring 2021, where the average was much lower. Researchers believe this dip in the scores could be related to the change from traditional face-to-face instruction to online with the use of remote testing and teaching during the COVID-19 epidemic (Rebman et al., 2021). The results from Spring 2021 could also be due to the removal of admission requirements by the university, allowing students to be admitted for courses that had no ACT score or scores lower than required in prior years. It is hypothesized that these students may not have been ready for a freshman-level computer applications course. A more in-depth look at the student records and demographics for that semester could possibly result in a better conclusion.

Table 2 gives a percentage of those students each semester who passed the exam with a score of 700 or higher. A score of 700 must be achieved for Microsoft to offer certification. The highest pass rate was observed during Fall 2020, while the lowest pass rate was observed during Spring 2021. Again, the Spring 2021 semester seems to be an unusual semester.

Table 2

Pass Rate Percentage by Semester

Semester	Pass Percent
Fall 2019	74%
Spring 2020	73%
Fall 2020	76%
Spring 2021	55%
Fall 2021	73%
Spring 2022	65%
Fall 2022	75%

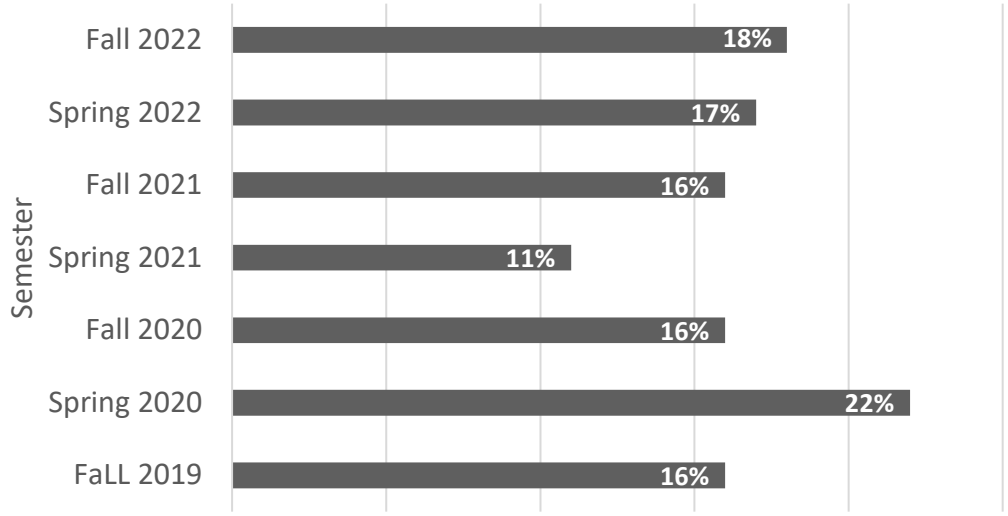
A student scoring 900 (90%) on the MOS Word 2019 Associate (MO-100) exam received an "A" letter grade in this course. Those students are assumed to be knowledgeable about the tasks needed to work in Microsoft Word. For this study, the instructors gave students enrolled during the Fall 2022 semester with a score of 900 or higher the opportunity to take the MOS Word 2019 Expert (MO-101) exam. The exam was optional and not mandatory. The Expert (MO-101) exam was given at the end of the Fall 2022 semester after these students completed the Associate (MO-100) exam.

Figure 1 shows the percentage of students who scored 900 or higher during all the semesters reviewed for this study. However, it must be noted that only the students during the Fall 2022 semester were given the opportunity to take the MOS Word Expert (MO-101) exam. When describing the semester student scores of 900 or higher, the percentages ranged from 11% to 22%. The highest number of students passing the test with 900 or higher was during the Spring 2020 semester while the lowest number was the Spring 2021 semester. Spring 2020 is the semester when the students were sent home midway to finish due to the Covid-19 pandemic. Instead of testing in the classroom, all students were allowed to test using the at-home proctoring system offered through

Certiport. One can speculate that there may have been some integrity violations happening during this semester. The testing procedures had to be learned quickly and there were some issues with delivery of the certification exams.

Figure 1

Percentage of MOS Scores 900 or higher by Semester



During the Fall 2022 semester students taking BUAD 1800 – Introduction to Computer Applications in the face-to-face classroom were offered the opportunity to take the MOS Word 2019 Expert (MO-101) exam free of charge if they scored 900 or higher on the MOS Word 2019 Associate (MO-100) exam. Just as with the Associate (MO-100) exam, the Expert (MO-101) exam must be passed with a score of 700 or higher to receive certification. There were 19 students eligible to take the Expert (MO-101) exam. Of those 19 only 6 elected to test. One of those six scored an 884 on the Associate (MO-100) exam but asked to be included in the trial sample. The scores students made on both exams can be seen in Table 3. Please note that two of the six did not pass the Expert (MO-101) exam with a score of 700 or higher. Four of the six (67%) taking the Expert (MO-101)

exam did pass it with a score of 700 or higher, giving them another Microsoft certification to add to their credentials.

Table 3

Fall 2022 Exam Scores for Students in Trial

Student	Word Associate (MO-100)	Word Expert Score MO-(101)
A	976	880
B	925	790
C	930	560
D	884	513
E	900	850
F	900	730
M	919.2	720.5
SD	32.7	152.3

Conclusion

Based on the current pass rate trends, it is unlikely that the School of Business (SOB) will choose to increase the requirements for the beginning computer applications course (BUAD 1800) to include both the MOS Word Associate (MO-100) exam along with the MOS Word Expert (MO-101) exam. During the study semesters, less than 20% of the students taking the MOS Word 2019 Associate (MO-100) exam passed with a score of 900 or higher each semester. Though it could be possible for any student to pass the MOS Word Expert (MO-101) exam, it would be unlikely that students scoring below 900 would be able to pass the exam. More testing of this hypothesis could be addressed during possible future research and study.

The School of Business at this university will likely look at trying to improve the overall pass rate for students on the MOS Word Associate (MO-100) exam. This could be done by offering

students an additional retake opportunity if they do not pass the MOS Word Associate (MO-100) exam on the first try. Though the ideal goal of having a pass rate of 100% might not be feasible, the instructors could strive to increase the pass rate to 80 or 90 percent each semester.

Post Secondary Expectations

There was a major decrease in pass rates during the Spring 2021 semester. It is believed this result could be due to the COVID-19 pandemic and the stresses caused to both higher education and students during that time period (Rebman et al., 2021). The university also removed all admission requirements for enrollment during that time, allowing many under-prepared students to take college classes.

The take-away based on the statistics and data of this study is that the course instructors will continue to require the MOS Word Associate (MO-100) exam and offer the Expert (MO-101) exam as optional to any student who wishes to obtain that additional certification. These students must first pass the Associate (MO-100) exam with a score of 900 or higher.

Implications for Future Research and Education

1. The School of Business at this university will continue to collect MOS Word Associate (MO-100) exam scores in future semesters.
2. The School of Business will continue to offer the MOS Word Expert (MO-101) exam to students who score 900 or higher.
3. The School of Business instructors will evaluate the textbook and learning materials annually to determine if any changes need to be made.

4. The authors of this exploratory study will consult with other similar universities to determine the requirements for similar computer application courses and will compare the success rates of those universities with the study population.

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Infrastructure in Crisis: Dealing with Deman During COVID-19

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Abstract

The COVID-19 pandemic caused many universities to cancel face-to-face classes and re-format them as online classes in a matter of days. The transition was unexpected and often difficult. This article presents one university's information technology services usage statistics during the pre-COVID-19 and post-COVID-19 parts of the Spring 2020 semester. To the authors' knowledge, this article is the first to publish detailed information technology usage statistics from an initial COVID-19 semester. In the post-COVID-19 weeks of the semester, information technology services usage increased by extraordinary amounts, often showing hundreds or even thousands of percentage point increases in usage as compared to the pre-COVID-19 part of the semester. Surprisingly, Learning Management System usage decreased, and email showed the least usage growth of any service that experienced an increase. Based on the findings, the experiences of faculty learning new communication technologies, and the methods used to access these technologies, the authors present a list of best practices specifically geared toward preparing information technology services and training programs for crisis situations such as pandemics.

Keywords: *COVID-19; coronavirus; pandemic; pedagogy; information technology; infrastructure; online/distance education; Education Administration issues; Faculty education/development*

INTRODUCTION

When reading the call for papers for the Journal of Marketing Education's special issue featuring the "Turmoil and Triumphs" of teaching during the coronavirus pandemic of 2020-2021, the authors of this paper found themselves uniquely prepared to answer the call. As part of a separate research project, the authors were monitoring student and faculty use of campus information technology services. When face-to-face (F2F) classes were cancelled in favor of online-only education due to COVID-19, we were able to track detailed information technology (IT) statistics for almost all campus IT services. This situation resulted in a semester-long look at campus IT usage leading up to and after the implementation of coronavirus protocols and the cancellation of face-to-face classes.

This article hopes to add to the literature about teaching during times-of-crisis, emergency, or unexpected situations in the following ways: (1) Our IT infrastructure usage statistics may help other universities predict which services would be most or least affected during a time of crisis; (2) Our data also shows changing behavior regarding what devices and platforms (specialized apps, browser-based internet access, etc.) students and faculty used to accessed campus IT services before and after COVID-19 protocols were enforced. From a consumer behavior perspective, this data may be helpful by guiding IT choices toward services that best support the methods that students access them; (3) Sharing the experience of our faculty in dealing with the quick transition to all online courses may be beneficial for others making such a quick transition; and (4) We suggest a list of best practices for crisis preparation, which focuses IT infrastructure preparation and faculty training.

Literature Review

While online and face-to-face pedagogical methods are well-researched areas of study, the dismissal of *all* face-to-face classes in favor of switching to online-only classes during a crisis event is a much rarer occurrence. Therefore, fewer researchers have had opportunities to investigate such situations. As with COVID-19, an extraordinary crisis event typically motivates the research. As Tull et al. (2020) state, such events are the "impetus to innovate" (p. 63). However, while rare, instances of such work do exist. Such examples include educational institution reactions to crises such as protests (Czerniewicz 2019), hurricanes (Dicarlo et al., 2007), earthquakes (Tull et al., 2020), floods (Bird et al., 2012), and several recent articles connected to coronavirus pandemic (e.g., Dhawan 2020; Lassoued et al., 2020; Arshad et al. 2020). Still, many of these events allowed for the resumption of F2F classes at other locations after a brief recovery period of days or weeks. The COVID-19 pandemic was somewhat different in that F2F classes could not resume within any reasonable amount of time because physical destruction of property or infrastructure – common with other disasters or crises - did not occur. Instead, the quarantine and social distancing measures lasted for months and made a return to F2F classes within days or weeks impossible.

Czerniewicz (2019) may present the closest parallel to the COVID-19 pandemic. At Cape Town University (CTU) in South Africa, the #FeesMustFall movement between 2015 and 2017 involved students protesting university costs, low government funding support for students, and various exclusionary practices that they felt affected their ability to attend universities. The protests involved "the disruptions of teaching and learning activities at the university by protestors, which included blockades at university entrances, the closing down of lectures in progress, the repeated setting off of fire alarms, and, in some instances, the destruction of equipment" (Czerniewicz, 2019,

p.12). Eventually, most university offices closed, and faculty were asked to move their classes into a "blended" environment, which in practice was a move to online-only education.

To facilitate the move, CTU relied almost exclusively on its Learning Management System (LMS), which appears to have been used primarily for hosting files such as videos and assignments, rather than synchronous class meetings. However, the LMS did support chat and forum posts, which allowed some synchronous communication. Czerniewicz points out that while not all faculty feedback was negative, many faculty members were not happy with the transition. This may have been partly because as a primarily face-to-face lecture-style university, CTU faculty may have felt more uncomfortable or forced into the transition than faculty at institutions with different cultures. The faculty also expressed concern that not all students would have access to the technology and equipment necessary for transitioning to "blended" education. While CTU's situation with all classes moving online early in a semester was somewhat similar to NSU's cancellation of F2F classes due to COVID-19, Czerniewicz makes no mention of CTU having access to services such as Zoom, Cisco WebEx, or Microsoft Teams, which were heavily used by many institutions during the COVID-19 pandemic.

In the case of Hurricane Katrina, which struck Louisiana on August 29, 2005, classes and local clinical rotations at Louisiana State University (LSU) School of Medicine were completely shut down due to the flooding and storm damage. The entire first floor of the medical school was flooded, and the IT infrastructure was completely destroyed. DiCarlo et al. (2007) state: "personnel worked 24 hours a day to install servers, network equipment, and back-up systems for a complete data center in Baton Rouge." (p. 746) Installing the equipment during the aftermath of Hurricane Katrina took weeks, and internet, email, cell phones, and landlines were malfunctioning or inoperable (Dicarlo et al., 2007, Krane et al., 2007). In neighboring New Orleans, only text

messaging worked (Krane et al., 2007). Therefore, LSU administrators set up dedicated websites hosted off-site to communicate with students, formed a plan to restore IT services, attempted to locate all students, and looked for temporary facilities to hold classes or new partner hospitals that would allow students in clinical rotations to complete their clinicals. Since Facebook and most other modern social media sites were not publicly available or did not exist in 2005, students, too, set up their own websites or used online bulletin boards to communicate with each other when possible.

By the end of September 2005, roughly a month after Hurricane Katrina, classes and clinicals had resumed. In the following years, several articles discussed the effects of Hurricane Katrina on higher education (e.g. Brisbon et al., 2020; Chauvin et al., 2008; DiCarlo et al., Griffies, 2009, Krane et al., 2007). While Hurricane Katrina was an obvious crisis situation with enormous damage to facilities and infrastructure, the relatively quick recovery (roughly one month to temporary F2F accommodations) made Hurricane Katrina quite different from the COVID-19 pandemic.

Tull et al. (2020) examine seismic movements (earthquakes and aftershocks) in New Zealand and Bird et al. (2012) discuss flooding in Australia. They both found that Facebook and social media were useful for contacting students. Tull et al., at the University of Christchurch (UC), go further and suggest that social media, particularly Facebook, played a significant role in the university's ability to contact students after earthquakes and aftershocks in 2010 and 2011. YouTube and Twitter also helped, and the earthquakes influenced the university to license the "lecture capture" software Echo360 following the 2011 earthquake. UC's LMS, Moodle, hosted a special area for faculty to communicate with each other, which proved highly successful. Over the course of two years, UC quickly moved into online education as necessitated by the disasters.

Over the last year, several articles have examined how universities and students adapted to the COVID-19 pandemic. Examples include Rippé et al., 2021; Dhawan 2020; Lassoued et al., 2020; and Arshad et al., 2020. Also, the *Marketing Education Review* and *The Journal of Marketing Education* are both publishing forthcoming special issues about COVID-19. Generally, the articles published thus far focus on the theme of teaching, particularly online, during the pandemic and recommend best practices for crisis preparation or transitioning to teaching online in unexpected circumstances. However, that description is not all-inclusive of the robust amount of research being conducted about COVID-19 and higher education. As the study of COVID-19 in higher education is a relatively new topic, with most articles only recently published in the last 6-12 months and many more forthcoming, a full discussion of COVID-19 related literature is beyond the scope of this literature review and likely best-suited for a meta-analysis at a later date. This article, in an effort to add to the building body of COVID-19 literature, attempts to differentiate itself from previously published articles by publishing IT infrastructure usage data and a list of recommendations that are particularly focused on IT preparation and contingencies during times of crisis. To our knowledge, no previous article has published university IT services usage statistics from a COVID-19 semester during which the transition from F2F to online classes took place.

METHODOLOGY

During the spring of 2020, the authors were collecting data about campus Learning Management System (Moodle) usage, email usage, device usage, and a variety of other information technology statistics. The university, Northwestern State University of Louisiana (NSU), is a moderately sized campus in the southern U.S. During the Spring 2020 semester, enrollment was 10,246 students, which at the time was near NSU's all-time high record enrollment, 75% of students were enrolled in at least one online class, 37% of all classes were online offerings, and 37% of all

students were only taking online classes (Mitchell, 2021; NSU Factbook 2019-2020; West, 2020). In its region, NSU is a leader in online education.

Depending upon the IT service, most of the data was collected through Google Analytics or through Microsoft Azure Analytics. For example, data about NSU's Learning Management System, Moodle, was collected using Google Analytics, while Microsoft Teams data was collected through the Teams administrator console, which is powered by Microsoft Azure. The purpose of the data collection was to examine student behavior from a customer service standpoint and consider where, when, and how students were accessing student information technology services as well as examine whether campus IT services were fitting those usage patterns in the best ways possible.

Faculty computers were included in the data gathering, but computer labs, faculty devices, and other on-campus connections, depending upon the analytics tool, could be filtered out by internet protocol (IP) address if the researchers desired. However, since this article analyzes total IT service usage, no differentiation between student and faculty usage was necessary. The data also showed how individuals were connecting to campus IT services. If they were connecting using a particular type of tablet computer (iPad, Kindle Fire, etc.), phone, or another device. Additionally, the operating system, operating system version, and device type were logged. While usage-by-device analysis was available, the number of kinds of devices accessing IT services was so plentiful, that for evaluation purposes, the general platform (iOS, Android, etc.) was the main statistic studied. The main services used on campus were Cisco WebEx, Microsoft Teams, campus email (provided by Microsoft Office 365), and Moodle. During the pandemic, Cisco WebEx and Microsoft Teams were mainly used for chats, audio/video conferences and/or online teaching, and both the web client usage and app usage for those services were collected. As much as possible, faculty teaching face-

to-face classes were encouraged to teach their classes synchronously online during the same time period as they would have taught face-to-face.

For analysis purposes, the data was divided into pre- and post-pandemic time frames. These are identified as "Pre-COVID-19" and "Post-COVID-19". January 13, 2020 through March 13, 2020 were chosen as the pre-COVID-19 dates, because they are from the beginning of the semester until classes were dismissed due to the pandemic. The post-COVID-19 dates range from March 30, 2021 through May 11, 2021, which include the day classes resumed after spring break until the day grades were due for the semester. To give a more detailed explanation, all in-person classes were suspended at the end of the day on Friday, March 13. On Monday through Wednesday, March 16-18, there were no classes. Instead, university administration instructed the faculty to use that time to prepare and transition to online course delivery methods. All classes resumed in an online environment on Thursday, March 19, but only for March 19 and March 20. Spring break was the following week (Monday, March 23 through Friday, March 27) and the researchers felt beginning the post-COVID-19 data analysis during the first full week of classes after the transition period and spring break would give the most accurate pre- and post-COVID-19 comparison. However, for the sake of completeness, time series charts included in this article contain the full semester, the brief March 19 and 20th resumption of classes, and the March 23-27 spring break.

Training

While NSU normally had a higher percentage of online courses than many universities, numerous faculty members were not accustomed to teaching online and had to be trained. To help deal with the transition to all online courses, the NSU Electronic and Continuing Education (ECE) department made training videos demonstrating how to use software tools as well as best practices for online teaching. The ECE also created videos to train students to use the various IT services

available to them, particularly Microsoft Teams and Cisco WebEx, but due to the large number students taking online classes at NSU (75% of students taking at least one online course), the students tended to have less difficulty making the transition. The videos were distributed through email links sent to students and/or faculty and staff.

However, faculty also made training videos for other faculty within their departments. These videos were usually discipline-specific and offered instruction that was sometimes unavailable in ECE instructional videos. In some cases, faculty members also made training videos for students. These videos tended to outline how class would function in the online environment and what software the faculty intended to use as well as tutorials about how to use the software. For faculty and staff, a Facebook group called "NSULA Faculty Helping Faculty" was also set up university administration and received extensive use. Some faculty went from having never taught an online class to teaching all online classes within a few days, so numerous training resources were very helpful.

RESULTS

Cisco WebEx

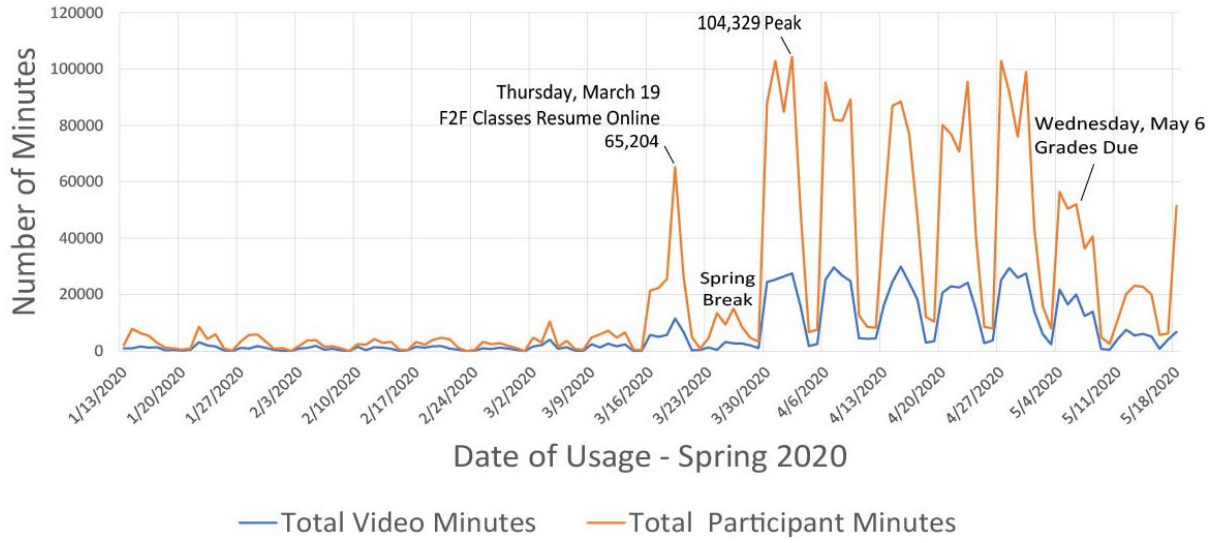
NSU uses two primary services for video chatting: Cisco WebEx platform and Microsoft Teams. These platforms were heavily relied upon for video conferencing, video-teaching, and all campus communication. The WebEx Total Average Video minutes increased by 1,474% from the pre-COVID-19 time frame to the post-COVID-19 time frame. Total Average Video minutes are average video stream minutes per day Similarly, participant minutes increased by 1,658%. Participant minutes are the daily average minutes someone is on a WebEx video call. In WebEx terms a video minute is per participant, per video. For example, if three individuals are on a 10-minute call, but only the first two are sharing video and the third person is only on audio, then the

first two individuals would account for 20 videos minutes (10 + 10 = 20): and the third person would only count for 10 participant minutes (not video minutes). Overall, WebEx would count the session as 30 minutes (20 video minutes and 10 participant minutes). In other words, "participant minutes" are essentially audio-only minutes when the participant is not sharing video. The Cisco WebEx video usage data for the pre- and post-COVID-19 timeframes can be seen in Figure I, and Figure II shows the change in usage over time.

Figure I: Cisco WebEx Average Video Minutes (Pre- vs Post-COVID-19)

WebEx Video Chat Usage			
Total Average Minutes	**Average Pre-COVID-19**	**Average Post-COVID-19**	**Percent Increase**
Video	1028.79	16,198	1,474%
Participant	3,000	52,726	1,658%

Figure II: Cisco WebEx Video Chat Minutes (Time-Series)



Microsoft Teams

Microsoft Teams is used for several services by NSU's campus, including team chat messages, private chat messages, voice calls, and video/audio meetings. When the data was being gathered, the university was making strides to transition to increased Microsoft Teams usage. The

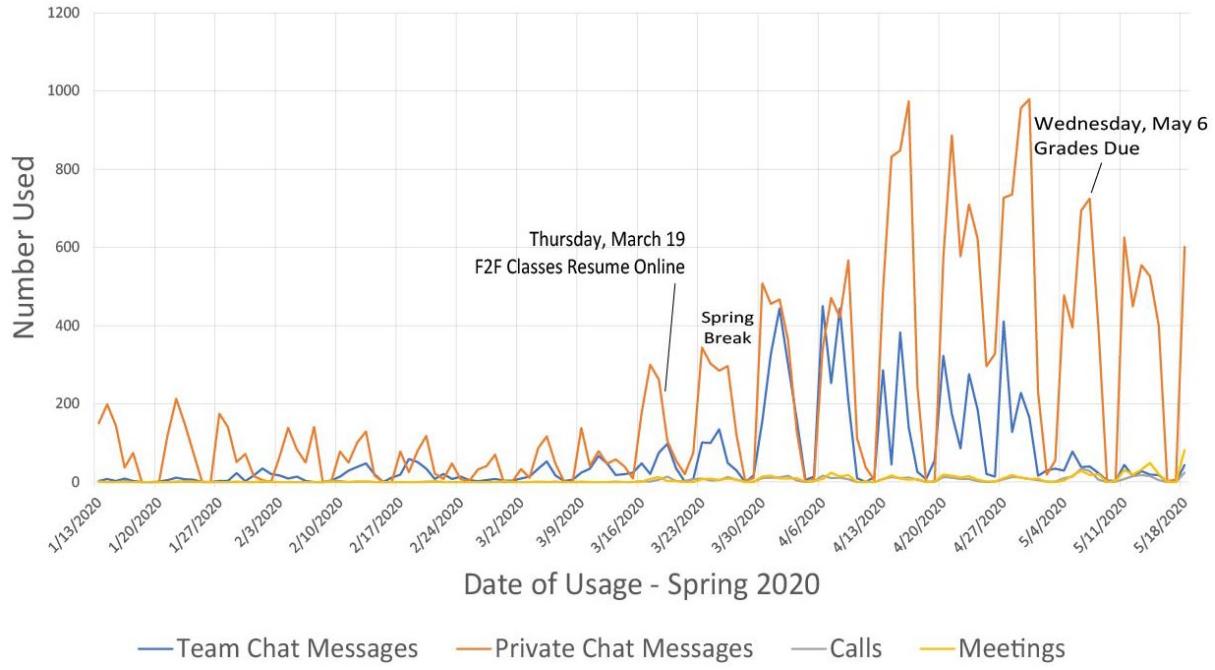
pandemic accelerated those plans. When comparing the pre- and post-COVID-19 Microsoft Teams usage, in the post-COVID-19 timeframe, average team chat messages increased by 820%, average private chat messages increased by 608%, average calls (both video and audio) increased by 2,312%, and meetings, which are prescheduled group video and/or audio calls, increased by 4,166%. A full breakdown of how Microsoft defines team chat messages, private chat messages, calls, and meetings can be found in Appendix A. (Please note that Microsoft Teams offers various tiers of service. Our tier only allows video and audio calls within the Microsoft Teams system. This tier does not allow calls to outside phone numbers. Only student, faculty, and staff/administrator accounts are registered in our Microsoft Teams system.)

These figures as well as time series data (data recorded at regular time intervals) for Microsoft Teams Usage can be visualized in Figures III and IV. Averages lower than one exist because WebEx was the university's preferred meeting platform before COVID-19 protocols. However, as the university was already planning to move toward Teams for meetings, calls, and messages, Microsoft's product was highly encouraged by IT staff and training as the preferred tool for classroom usage after F2F classes transitioned to an online format.

Figure III: Microsoft Teams Usage (Pre- vs Post-COVID-19)

Teams Usage			
Communication Type	**Average Pre-COVID-19**	**Average Post-COVID-19**	**Percent Increase**
Team Chat Messages	15.36	141.33	820%
Private Chat Messages	60.07	425.30	608%
Calls	0.33	7.91	2312%
Meetings	0.23	9.79	4166%

Figure IV: Microsoft Teams Average Usage by Service (Time Series)



Platforms Used to Access Microsoft Teams

Microsoft Teams supports usage across numerous devices and operating systems including almost any device capable of opening a web browser as well as dedicated apps for most mobile phones and tablets, including Android and iOS devices. As students constituted the vast majority of individuals accessing university services, the researchers felt it was important to look at how the pandemic changed the way students were accessing their instructors and classes.

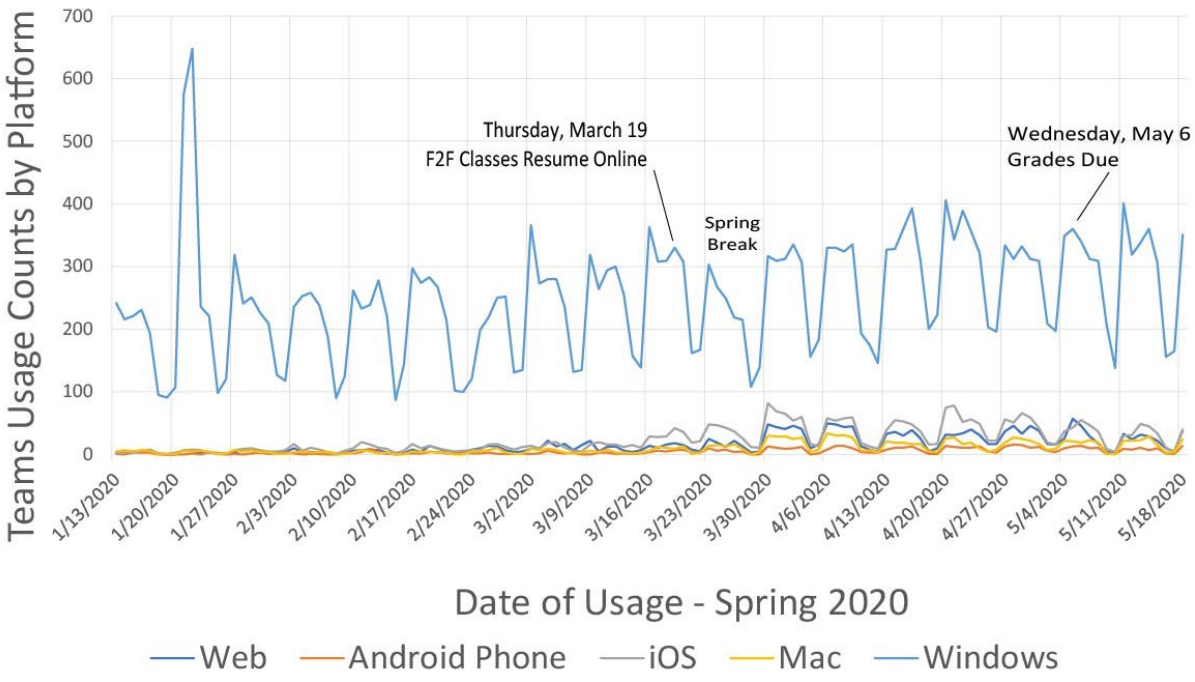
Regardless of platform, the Teams and WebEx apps were extremely useful for faculty and students. For example, since campus offices were closed, two authors told their students that they could simply call their professor's cell phone through the Teams app. Using Teams, students could call their professors, but professors would not have to provide their personal phone numbers. Some students, in their ratings of instructors, even left comments praising the availability of their instructors via Teams.

Regarding Teams usage, the data revealed that Microsoft Windows (laptops and desktops) remained mostly stable with only a 30.5% increase in app usage. However, iOS app usage increased by 373.5%, Android OS devices app usage increased by 356.8%, Macintosh OSX app usage increased by 341.3%, and browser-based access (regardless of the operating system or device) increased by 353.4%. These usage patterns can be seen in Figures V and VI.

Figure V: Microsoft Teams Usage by Device (Pre- vs Post-COVID-19)

Teams Usage: By Platform			
Platform*	**Average Pre-COVID-19**	**Average Post-COVID-19**	**Percent Increase**
Web	6.607	29.953	353.4%
Android Phone	1.934	8.837	356.8%
iOS	8.934	42.302	373.5%
Mac OSX	4.000	17.651	341.3%
Windows	223.262	291.419	30.5%
*"Web" refers to browser-based Teams access. All other platforms used dedicated Teams software apps.			

Figure VI: Teams Platform/Device Usage: User Counts (Time Series)



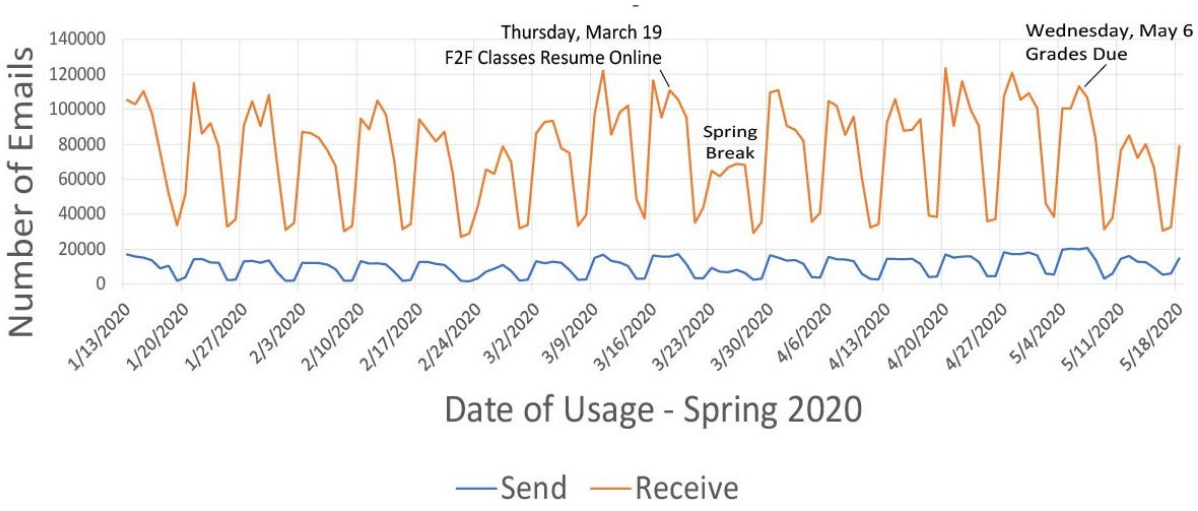
Email Usage

The overall university volume of sent emails increased by 33.9% in the post-COVID-19 timeframe, and the volume of read emails increased by 11.4% as well. Figures VII and VIII visualize these changes.

Figure VII: Email Activity Counts (Pre- vs Post-COVID-19)

Email Activity Counts			
Email Activity	**Average Pre-COVID-19**	**Average Post-COVID-19**	**Percent Increase**
Sent	9084.39	12164.05	33.9%
Read	72852.13	81133.14	11.4%

Figure VIII: Email Activity Counts (Time Series)



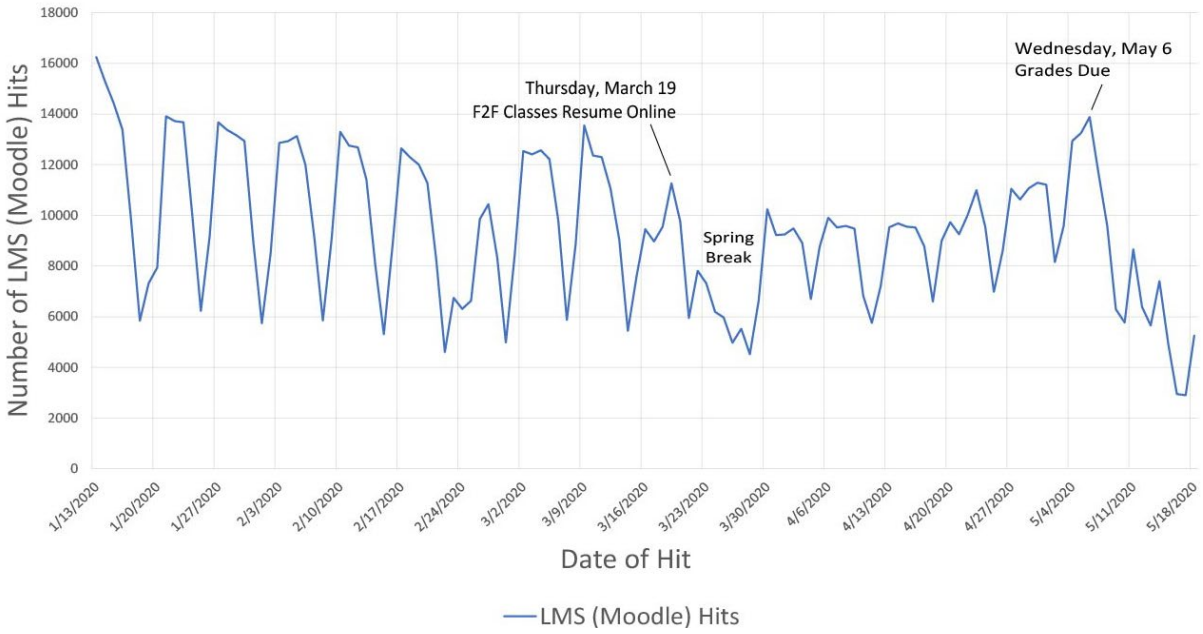
Learning Management System – Moodle

Google Analytics was used to gather website hits to the LMS home page, and hits to the Learning Management System surprisingly decreased in the post-COVID-19 time frame. The volume of LMS hits in the pre- and post-COVID-19 timeframes can be seen in Figures IX and X.

Figure IX: Learning Management System (Pre- vs Post-COVID-19)

Learning Management System (Moodle) Website Hits Per Day		
Average Pre-COVID-19	**Average Post-COVID-19**	**Percent Decrease**
10425.16	9386.30	-9.96%

Figure X: Learning Management System (Moodle) Hits Per Day (Time Series)



DISCUSSION AND ANALYSIS

Rather than discuss the minutia of each data set, the discussion will focus on the most important results and their associated faculty experiences during the beginning of the COVID-19 pandemic. However, we hope that the tables and charts presented thus far are useful to other institutions when trying to prepare for or predict increases in demand for IT services during times of crisis.

As expected, almost all services, except for email, had drastic increases in usage. Cisco

WebEx services had large increases in both average number of participants, meetings, and video and participant minutes used. However, despite the robust usage statistics, in faculty meetings with over 25 people, the video and audio quality degraded and the service became unusable for some users. This happened on multiple occasions. However, this problem may have been hardware based as WebEx often requires specialized equipment, or the university's enterprise subscription to the service may not have been robust enough to accommodate the unexpected demand. Microsoft Teams, though, functioned well, regardless of seeing even bigger usage increases. This result could have been because of differences in enterprise subscription tiers, local hardware limitations, or the scalability of the services themselves.

Testing the IT services under load during the pandemic, reading the usage statistics afterward, and talking with faculty lead the research team to four IT infrastructure-related recommendations:

First, based on WebEx's unexpected failure to effectively host large meetings, IT services should be tested under load. For example, until F2F classes were dismissed, the authors had no idea which IT services would remain stable during the extreme spike in usage. While Cisco WebEx's usage stayed extremely high in the post-COVID-19 timeframe, Microsoft Teams was used for most large meetings, such as classes, and voice calls. Therefore, WebEx's usage tended to be used for small meetings like student advising. Many faculty liked WebEx's "Personal Room" feature, which provides a permanent link that students can join through any browser or the WebEx app and instantly talk or video chat with their professor. Faculty experienced with Microsoft Teams made videos showing students how to call a faculty member's cell phone through the Teams app, which is supported by most major mobile and desktop operating systems. Students, who tend to be highly familiar with mobile phones and apps, quickly embraced this adaptation.

Second, multiple services should be used to diversify the risk of one service failing under high load. In our case, Teams and WebEx supporting each other by being better at specific needs. Also, some faculty used YouTube, Vimeo, or other services to share non-streaming video content. Facebook was used for faculty communication (the NSU Faculty Helping Faculty Facebook group), and prior research has shown that Facebook has been used in times-of-crisis for student/faculty communication (Tull et al, 2020; Dabner 2012). Multiple services, even services outside of the university, can be used to create multiple backup contingency plans. While using services outside of the university's control has potential complications, they may be more reliable should a university's IT infrastructure become unavailable.

Third, administrators should implement a disaster preparedness training program to better prepare faculty for sudden transitions from F2F to all-online classes. The amount of training needed was somewhat surprising, and in retrospect many faculty members could have been better trained and prepared for the move to all-online classes. In the authors' anecdotal experience, training videos made by faculty in a specific department were favored over the training videos prepared by the Electronic and Continuing Education (ECE) department. The departmental videos often explained or used specialized software, teaching techniques, or assignments from a specific discipline, while the ECE videos were more generalized. The faculty likely favored the more specialized videos because those videos may have been relevant to their needs. The Facebook group for faculty, NSULA Faculty Helping Faculty, was also highly successful in helping faculty learn from each other and still sees daily to weekly use for a multitude of faculty questions, even after almost all campus COVID-19 protocols have been rolled back.

Fourth, IT services that support numerous devices with specific well-designed apps or mobile web pages should be prioritized. The authors say "well-designed" because although some

Learning Management Systems (LMS) or other software platforms technically support mobile web pages or have apps, the quality-in-use of such tools can vary greatly by provider. The data indicated that the use of dedicated apps for iOS, Android, and Macintosh OSX increased more than access by web browsers. Generally, the increase in iOS and Android devices suggests that students greatly increased the amount of mobile device (cell phones, tablets, etc.) usage for classes in the post-COVID-19 timeframe. Classes that were held synchronously over video or audio chat also allowed students to attend class using such devices. Also, both Teams and WebEx support messaging, video calling, and audio calling over apps, and some faculty set their mobile phones up to allow students to call or message their mobile phones directly through the Teams app, but without the necessity of having to give students their personal phone numbers.

Perhaps the most surprising piece of data was that LMS (Moodle) usage decreased in the post-COVID-19 time frame. In fact, the peak number of hits to the Moodle site was during the first day of classes, January 13th when the site received 16,249 visits. While some students dropped classes over the course of the semester, reasons for the nearly 10% drop in usage are somewhat unclear. The research team suspects that services like Microsoft Teams, which can host files and be used for class-wide discussions, may have taken some traffic away from Moodle.

Additionally, faculty had recommended the mobile apps for Teams and WebEx to students. The platform usage statistics indicate that many students embraced these recommendations and began using mobile devices or tablets rather than desktop computers in the post-COVID-19 timeframe. Thus, the heavier reliance on mobile devices and associated apps may have also contributed to the decline in LMS usage. While Moodle mobile apps do exist, they were not widely used or recommended by faculty, but Teams and WebEx were introduced to students with emphasis on the ability to use mobile apps.

Students likely associated Moodle with Windows desktop usage, which was the largest platform used for Teams in the pre-COVID-19 timeframe but saw the lowest growth in the post-COVID-19 timeframe. The data indicates that students, most likely those transitioning from F2F to online classes, may have increased their usage of mobile devices and mobile apps instead of using Windows based desktops. Social distancing protocols in on-campus labs and facilities may have limited access to desktops for some students, too, which would also affect the data. Yet another possibility is that the apps for Teams and WebEx were superior to Moodle's app or mobile site support, so students simply avoided using Moodle on their mobile devices.

Email usage, too, was not affected as much as other information technology services on campus. One reason for this anomaly might be that email was already a heavily used service on campus, so the increase in usage was proportionally much smaller than with other services. Alternatively, services such as WebEx and Teams chat and calls may have taken a portion of the increased service load away from email. Prior research has indicated that students sometimes view email as a "slow" method of communication, and the ability, in many cases, to message professors and ask questions through the mobile phone apps of Teams and WebEx may have been more appealing to students or made them less likely to rely on email (Horton, 2017). To categorize the communications methods more clearly, students may see "messenger" and "chat" services as more synchronous, instant forms of communication, while they view email as asynchronous, with longer delays between responses.

Limitations and Future Research

The unique characteristics of NSU, such as its location, size, local culture, and student body demographics, will limit the generalizability of the data. In particular, since 75% of NSU students were taking at least one online class before the pandemic, NSU may have been more prepared for

the pandemic than many universities. This fact may cause our infrastructure usage data to underestimate the IT infrastructure usage increases that similar-sized, but less online-oriented, universities faced. Additionally, the IT services that NSU subscribes to likely differ from the services used at many universities. Therefore, direct comparisons may be difficult.

Another limitation is that most prior times-of-crisis in the last few decades involve a substantial crisis event (flood, earthquake, protest, etc.) followed by a recovery time. COVID-19 was unique in that when pandemic protocols began, they remained constant. There was no "event" followed by a recovery time as with most natural disasters. Therefore, the infrastructure data presented here is unique in that no typical resumption of face-to-face classes occurred at all or was expected to occur. Students were unable to resume classes at a new facility or location, and transferring to another university to finish the semester would yield no solution to COVID-19 protocols.

Future research might involve the long-term ways in which times-of-crisis affect faculty-student communication. For example, the reliance on Microsoft Teams by our faculty and students was rushed ahead by several semesters. Instead of a slow integration and dissemination of training throughout the university, many faculty members and students had to learn to use the service within a few days, and the full effects of these changes have yet to be seen. Still, anecdotal discussions with faculty, staff, and students have been positive. In fact, the following semester, in Fall 2020, NSU saw robust growth with an all-time high enrollment of 11,447 students despite many sources predicting declining enrollments due to COVID-19 (West, 2020). While many factors affect enrollment, the unexpected growth lends credence to students viewing the Spring 2020 semester as a success. However, clear research considering how faculty and students viewed the technological

innovations and resulting changes in communication brought about by COVID-19 would be beneficial to educators.

Another potential area of research is the problem of competing solutions. While WebEx and Teams were the primary university-provided communication services, some faculty still preferred Zoom, YouTube, Microsoft Stream, or other services or combination of services. While some faculty members were happy with their custom solutions to educating during the pandemic, the use of outside services may slow down or complicate planning for a crisis or may even create legal liability issues regarding the security of student data of faculty-student communications.

The Center for Disease Control (CDC) website currently lists at least four past pandemics between 1918 and 2009, not counting the COVID-19 pandemic of 2019-2021, which the CDC web site has not yet added to the list. While recent history suggests that pandemics occur about four to five times a century, the impact and severity of COVID-19 on industrialized nations with widespread access to modern healthcare was unprecedented. Considering the extraordinary nature of COVID-19 and that pandemics are expected to become both more frequent and more severe (Dodds, 2019; New Wires, 2020), our hope is that the infrastructure data and list of recommendations presented in this article will inspire and give insight into other possible research projects as well as help educational institutions better prepare for similar situations, which may occur sooner than expected.

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Appendix A

Teams Activity Report Definitions

The definitions of the communication types above are defined by Microsoft (2021) in the follow ways:

- Team chat messages are “Messages a user posted in a team chat.”
- Private chat messages are “Messages a user posted in a private chat.”
- Calls are “1:1 calls a user participated in.”
- Meetings are the “number of meetings a user participated in.”

Adaptive Tech in Crisis: A Case Study on Low-Code and SaaS Technologies for Digital Transformation

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Abstract

Amidst a backdrop of global pandemics, political instability, climate change, and economic volatility, organizations with limited IT capabilities can benefit from low-code development (LCD) and Software as a Service (SaaS) to enhance adaptability and agility in their digital transformation journeys. Through an inductive case study of Nivati, an employee wellness enterprise, we delineate the "4 Steps of Digital Transformation," providing a structured approach for service-oriented organizations to effectively leverage LCD and SaaS in reshaping their business models and service offerings to thrive in challenging times.

Keywords: digital transformation, SaaS, low-code development, crisis response

Introduction

Organizational crises, an unfortunate yet inevitable aspect of global business operations, necessitate the ability to adeptly reorient business models and corresponding technological frameworks in response to such disruptions. This often-complex task is fraught with ambiguity and a lack of precedence as organizations must navigate uncharted waters to maintain operational continuity and viability. In the context of the COVID-19 pandemic, the imperative to minimize face-to-face interactions engendered unprecedented constraints on myriad industries. This has been particularly impactful for sectors heavily reliant upon interpersonal engagement, such as healthcare, personal and legal services, and education. In these fields, traditional modes of operation were disrupted, thereby compelling organizations to rapidly adapt to new ways of delivering value to their customers and clients.

While certain organizations faltered in their endeavors to adapt their business models and successfully execute the requisite digital transformation, others seized the opportunities engendered by these and other crises. Recognizing the potential for growth and innovation, these organizations strategically employed accessible technologies such as low-code development (LCD) and Software as a Service (SaaS) to expeditiously revolutionize their workforce and service offerings.

LCD and SaaS technologies enable organizations to rapidly develop and deploy digital solutions with minimal programming expertise. By leveraging these platforms, businesses can be more agile in response to disruptions, swiftly implementing changes and customizing solutions to meet evolving needs. Consequently, organizations, such as the one presented in this study, that embraced these technologies demonstrated greater resilience, flexibility, and adaptability in the face of adversity, setting themselves apart from their less responsive counterparts. By doing so,

organizations can ensure their survival and continued success in an ever-changing and increasingly digital landscape.

The process of adaptation and evolution instigated by an organization's adoption of digital technologies, as characterized in the literature (Wessel, et al., 2021; Vial, 2019), is termed digital transformation. This transformation transcends mere digitization, as it encompasses a comprehensive shift within an organization, necessitating alterations to established business models, paradigms, and organization culture (Mergel et al., 2019; Wessel et al., 2021). Conventionally, organizations embark on digital transformation journeys to bolster their competitive advantage in the marketplace (Bharadwaj et al., 2013); however, in the case of Nivati, the organization pursued digital transformation not only to enhance its market positioning, but also to navigate an unprecedented crisis.

LCD and SaaS

LCD furnishes a user-friendly graphical interface, enabling users to employ drag-and-drop functionality with minimal or even no coding expertise. The incorporation of readily available, pre-built modules (e.g., APIs, UI components, database connectors, etc.) within LCD platforms accelerates the development process, rendering these platforms accessible and easy to learn and utilize (Luo, Liang, Wang, Shahin, & Zhan, 2021). Moreover, the incorporation of cloud-based SaaS assists organizations in circumventing substantial capital expenditures, instead allowing for the adoption of functionality as a relatively cost-effective operational expense (Godse & Mulik, 2009). Owing to the inherent simplicity, expedited learning curve, widespread accessibility, and reduced capital costs associated with such technologies, the employment of LCD and SaaS can greatly assist organizations in adapting to digitally transformed business models.

Nivati as a Case Study

The extensive transformation undertaken by the employee wellness enterprise, Nivati, offers an insightful examination into how service-oriented organizations can rapidly and proficiently harness LCD and SaaS technologies to reorient their business model and service portfolio, thereby persevering amidst crises.

Overview of the Organization Prior to the Crisis

Prior to the outbreak of the COVID-19 pandemic, Nivati, formerly known as Incorporate Massage, was a service organization that specialized in partnering with corporations to deliver on-site massage services as a holistic wellness offering for employees. Boasting a workforce of over 1,000 massage therapists and an additional 40 personnel, Incorporate Massage's business model was primarily centered on in-person massage services, accounting for 99% of its total sales revenue. In 2019, the company was on track to achieve $6 million in annual revenue.

At that time, the organization's principal technological infrastructure comprised a custom .NET application designed for scheduling purposes, which was concurrently undergoing integration with the Salesforce platform. However, the advent of the COVID-19 pandemic in early 2020 precipitated a dramatic shift in Incorporate Massage's business landscape. As the pandemic swept across the United States, Incorporate Massage's operations were abruptly suspended, with sales plummeting to unsustainable levels.

The pandemic served as a catalyst for driving technological innovation and adaptation within the organization. Recognizing the imperative for change, Incorporate Massage embarked on a transformative journey, leveraging simple technologies, and embracing new digital strategies to

ensure its survival and continued success in an increasingly uncertain and rapidly evolving business environment.

The Digital Transformation

Confronted with unfulfilled contracts for numerous corporations and no viable means to fulfill them, Incorporate Massage found itself compelled to adapt. After rebranding as Nivati and embracing a broader vision as a comprehensive digital wellness company, the company engaged with various clients to ascertain the scope of services they could potentially provide. Nivati subsequently approached their massage therapists to determine which alternative services they could supply. These inquiries culminated in the repositioning of massage therapists into roles as certified yoga instructors, nutritionists, and life coaches. In July 2020, the company initiated the delivery of live and on-demand wellness services, including yoga, meditation, life coaching, and nutrition counseling, via Zoom and Vimeo. By utilizing these Software as a Service (SaaS) products, Nivati employed a straightforward and financially viable solution to offer needed services to their clients. Utilizing Salesforce as a low-code platform to manage customer relations and host their burgeoning website, Nivati regularly updated and posted videos.

Following further consultations with their expanding clientele regarding their wellness requirements, in October 2020, Nivati introduced live mental health counseling services. These services rapidly gained traction and emerged as the most popular offering of the business. This revelation prompted Nivati to employ additional certified counselors and broaden the scope of their virtual offerings to encompass a mobile application, advanced scheduling software, database and backend support, and gamification features, all constructed utilizing LCD and SaaS technologies. In

a span of just over six months (from March to October 2020), Nivati successfully navigated the challenges posed by the COVID-19 crisis and underwent a comprehensive digital transformation.

The 4 Steps of Digital Transformation

To facilitate the company's digital transformation utilizing LCD and SaaS, Nivati underwent the following sequential phases:

1. Evaluate service offerings and capabilities
    - Engage with clients to ascertain their receptiveness to virtual service delivery
    - Consult with employees to appraise their diverse skill sets and readiness to adapt to new roles
2. Develop a prototype
    - Adopt proposed solutions and assess their efficacy through pilot testing
3. Refine through iterative discovery
    - Implement the services, continuously enhancing them based on customer feedback and interactions
4. Optimize the systems and technology infrastructure
    - Facilitate the evolution of the tech stack in alignment with the organization's strategic pivot

The four-phase framework constitutes a systematic approach that enabled Nivati to expeditiously reorient their business model and execute a comprehensive digital transformation. This paradigm proved efficacious for Nivati as a relatively small, service-centric organization; however, its applicability extends beyond the confines of this specific context. The adaptable nature of this framework allows for its potential implementation in both strategic and crisis-driven scenarios across a diverse range of organizational structures.

Step 1: Evaluate service offerings and capabilities

During the initial phase of their digital transformation, Nivati placed paramount importance on the evaluation of their service offerings and operational capabilities. As a massage company

navigating the complexities of a socially-distanced economy, comprehending what they could supply to the market and identifying which services would be amenable to digital delivery was crucial. This understanding was attained through direct engagement with Nivati's existing clientele and a thorough appraisal of their workforce.

CEO Amelia Wilcox underscored the significance of assessing market demand prior to initiating a digital transformation, asserting that Nivati needed to “see if people want what we have and the way we deliver it.” Although faced with the necessity to furlough all Nivati's massage therapists, the organization probed the therapists for alternative skills they possessed and investigated avenues to facilitate skill development through training. By examining their available resources, the management team was able to seize the opportunity for digital transformation and refine their service offerings to encompass an array of virtual services. These included live and on-demand instruction in massage, yoga, meditation, life coaching, and nutrition, thereby catering to the evolving needs of their clientele in an increasingly digital landscape.

Step 2: Develop a prototype

Following the rebranding as Nivati and the adoption of a comprehensive digital wellness vision, the organization embarked on strategic plans to deliver their services in a virtual format. Prior to the pandemic, Nivati's technological infrastructure was limited to a custom .NET application for scheduling, spreadsheets functioning as a rudimentary database, and nascent plans to integrate the scheduling application with Salesforce. Operating with constrained resources, Nivati employed LCD SaaS to construct the infrastructure to host their virtual offerings.

During the transformation period, a considerable portion of the organization's limited budget was allocated to compensate a Salesforce consultant who assisted in developing the new technology

stack. Although this expenditure was substantial, it facilitated savings on capital expenses as the technology team was streamlined from seven full-time developers to a significantly leaner composition, consisting of a Chief Technology Officer, the Salesforce consultant, and one offshore developer.

Utilizing SaaS and LCD, Nivati progressively developed a prototype by integrating various out-of-the-box products with Salesforce as the central component. This included Vimeo for asynchronous video streaming, Twilio for client communication, and Zoom for conducting virtual appointments. Amazon Web Services and Salesforce constituted the core of Nivati's platform, hosting and facilitating the development of their entire website. All virtual offerings were channeled through the website, which incorporated payment services and a scheduling application.

As new technologies emerged, both the structure and functionality of the platform transformed. Through a process of implementation, testing, and configuration, Nivati's offerings gradually matured into a refined product capable of gaining traction in the competitive market landscape.

Step 3: Refine through iterative discovery

Following the launch of their digital employee-wellbeing services, Nivati persistently refined their offerings through an iterative process. The management team proactively solicited client feedback and identified opportunities to broaden their services, enhancing their overall effectiveness. Nevertheless, Nivati faced a challenge as their video libraries struggled to gain traction. The competition from free video platforms, such as YouTube, rendered Nivati's initial offerings—including yoga, nutrition counseling, and massage instruction—less enticing to their target audience.

Upon receiving a client's suggestion to incorporate mental health counseling into their virtual services, Nivati seized the opportunity and integrated certified therapists into their platform. Mental health counseling swiftly emerged as the most lucrative aspect of Nivati's business, prompting the onboarding of additional therapists. To expedite the expansion of their counseling services, Nivati leveraged Zoom and the LCD capabilities of Salesforce in conjunction with their website.

Nivati's client-centric approach enabled them to address the demand for employee-wellness services beyond traditional office settings. Utilizing Salesforce, Nivati promptly developed a mobile application to deliver video content and schedule therapy sessions. They employed the drag-and-drop functionality of LCD to create this application, thereby enabling clients to access video content and therapists to schedule and manage appointments. The rapid deployment of this mobile app was crucial for addressing the distinct needs of clients and employees.

Step 4: Optimize the systems and technology infrastructure

As Nivati aspires to expand on a global scale, the organization acknowledges the critical need for continuous improvement of its technology stack. The trajectory that Nivati, like any other company, pursues depends on various factors such as financial feasibility, the scope of their offerings, and the success of their current stack. Nivati has multiple avenues to refine its systems.

One option is to maintain the current stack, which was constructed primarily using SaaS and LCD. However, this stack presents certain limitations in terms of customizability, integration with other software, and configurability. These constraints circumscribe Nivati's ability to provide highly specialized solutions and offerings. Nevertheless, retaining the current system would enable Nivati to capitalize on the existing infrastructure and persist with their current strategy.

Alternatively, Nivati could leverage its newly consolidated market position to justify constructing an adapted solution tailored to its unique requirements. CEO Amelia Wilcox expressed that rationalizing the financial cost and investment of time for a custom build would be challenging without preliminary evaluation of their virtual offerings in the marketplace. Consequently, she advocates to "buy before you build because you can always build later." Now that Nivati has successfully implemented digital transformation through the use of SaaS and LCD, navigated the crisis, and ascertained the market success of its offerings, the organization can justify transitioning from an off-the-shelf solution to constructing a proprietary platform.

Benefits of Digital Transformation Using Low-code and SaaS Technologies

Nivati's strategic choice to employ a technology stack underpinned by LCD and SaaS proved to be a crucial factor in their survival as a digitally transformed enterprise with virtual offerings. This digitization yielded numerous advantages, including the capacity to extend their business model globally, thereby reaching a broader range of potential clients irrespective of geographic constraints. Consequently, the company's multiplier valuation experienced a significant increase of over five-fold, as they are now recognized as a technology-oriented firm. Furthermore, Nivati's technology stack, built upon LCD and SaaS, affords them the flexibility to adapt to internal shifts, technological advancements, and industry disruptions. This adaptability enables Nivati to respond rapidly to market changes and sustain a competitive advantage.

Figure 1 displays the findings of a survey carried out in 2020, by BetterCloud, a platform renowned for its expertise in managing and securing SaaS environments. The survey aimed to gather insights from IT professionals who actively employ SaaS technologies within their organizations, thereby shedding light on the primary motivations driving the adoption of SaaS solutions. The

graphical representation elucidates the key factors that propel IT professionals to implement SaaS. Among these, the most salient drivers are an increase in productivity (54%) and the reduction of costs (35%). In addition to the enhancement of productivity and the reduction of costs, the integration of SaaS solutions fosters a myriad of additional advantages including increased scalability, streamlined operations, more accessible software updates, improved security, and reduced time to market for new products and services. Consequently, embracing SaaS solutions can play a pivotal role in enabling companies to achieve their strategic goals and maintain a competitive edge in today's rapidly evolving business landscape.

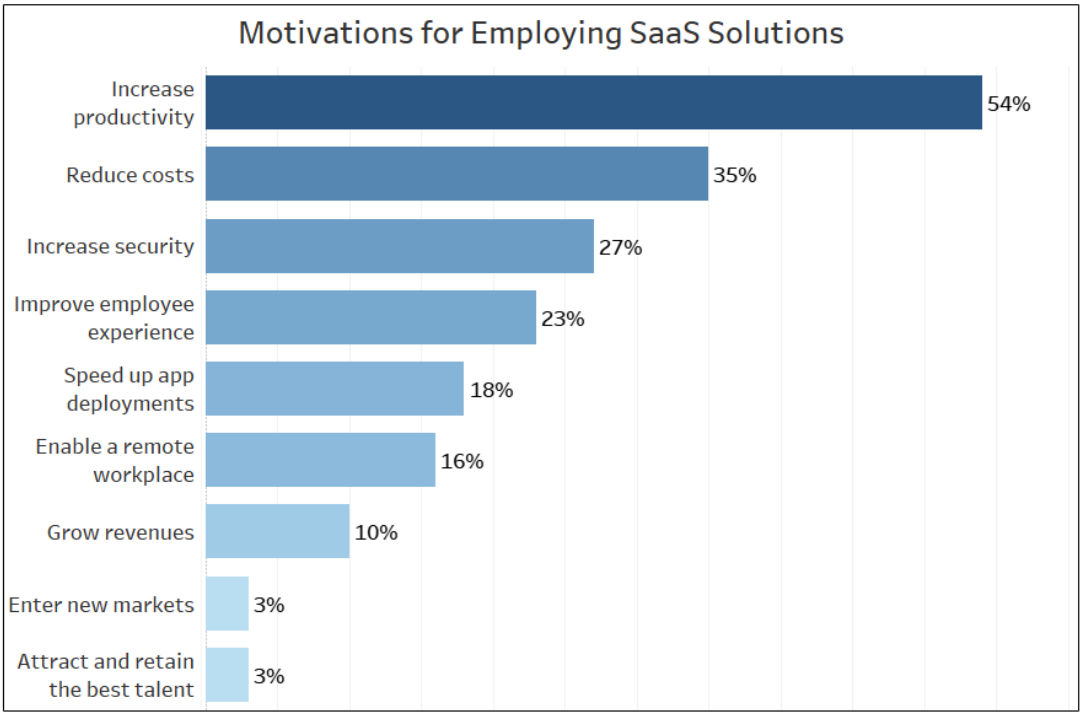

Figure 1: Motivations of IT professionals for employing SaaS solutions in their organization (adapted from BetterCloud, 2020)

Challenges of LCD and SaaS

While Nivati successfully leveraged LCD and SaaS for their digital transformation, they were not without challenges stemming from inherent limitations of these technologies. One of the primary weaknesses they encountered was the restricted customization options available in out-of-the-box SaaS solutions. This constraint hindered Nivati from tailoring their virtual offerings to specific client needs or unique business requirements, potentially affecting the overall user experience and their competitive edge in the wellness industry.

Moreover, Nivati faced difficulties in troubleshooting and maintaining their LCD and SaaS-based platform due to the limited customization capabilities of these technologies. As they relied on pre-built components, identifying and resolving issues proved challenging, particularly when the desired modifications were beyond the scope of the provided components. This led to increased reliance on external consultants and additional expenditures. For instance, Nivati found that the vertical display of all video content on Android devices compromised their mobile app's usability when viewed in horizontal orientation. Had the app been developed by an in-house team of developers, addressing this issue would have been within their control.

Another challenge Nivati faced in adopting LCD and SaaS was the dependency on third-party vendors for the provision and management of the software. This made the organization susceptible to vendor lock-in, which can complicate switching providers or migrating data between systems. Additionally, potential service disruptions or security breaches at the vendor level can have significant impacts on Nivati's operations, data privacy, and overall reputation.

Therefore, it is essential for organizations such as Nivati, to carefully evaluate the trade-offs between the benefits and potential drawbacks, as well as assess the alignment of these technologies with their specific needs, objectives, and long-term strategic vision.

Nivati Going Forward

The present state of Nivati's revenue streams shows that their counseling services constitute 80% of the company's revenue, while the remaining 20% is from their video library. Nivati is currently experiencing 100% annual growth due to the success of their digitally transformed employee-wellness organization. As such, the company is poised to continue this growth trajectory as they remain committed to providing virtual wellness services that can be accessed globally. In light of the success of their digital transformation, Nivati has strategically opted to concentrate on the continued development and expansion of their virtual wellness offerings. The company does not foresee the reintegration of corporate massage services into their future business model, signifying a clear departure from their initial service provision. This decision underscores the adaptability and resilience of Nivati in navigating the evolving market landscape and capitalizing on emerging opportunities to ensure sustained growth.

Conclusion

This case study exemplifies how service-oriented organizations can proficiently execute a digital transformation amidst crises, primarily through the strategic employment of SaaS and LCD technologies. While limited in some respects, the inherent simplicity, cost-effectiveness, and adaptability of SaaS and LCD platforms empower companies to expeditiously react to unforeseen circumstances or execute strategic organizational shifts. By leveraging these technological solutions,

organizations can adeptly modify their offerings to deliver value within the competitive digital marketplace, thereby ensuring business continuity and resilience in the face of adversity.

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Using Starburst Candy to Demonstrate Sampling in an Introductory Statistics Course

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Abstract

This research presents an active learning lesson conducted at a small four-year regional institution in an introductory business statistics course. This activity used candy and small group work to demonstrate sampling to the students in the face-to-face sections of the course taught in the Fall 2021 semester. A comparison of the exam scores covering the topic for the online sections versus the face-to-face sections of the course showed that the students who participated in the active learning lesson scored significantly better than those not presented with the activity.

Keywords: Active learning; Sampling; Higher education

Introduction

The term statistics can be daunting for many students. At a small four-year regional university, introductory business statistics is taught to all college of business majors. Admissions requirements are not rigorous, and many students need more basic math skills. Teaching statistics to students that feel they need to improve at math and are afraid to take any course related to math can be challenging. Presenting material for multiple learning styles can be the key to success in in this type of statistics classroom. The purpose of this paper is to discuss a Starburst Candy lesson to demonstrate sampling in an active way in an introductory undergraduate statistics course. The goal is to increase student engagement, participation in the lesson, knowledge, and understanding of sampling methods.

Active Learning in Statistics

University classrooms traditionally present material passively, hoping students can retain and absorb material through lectures. While this approach is still valid, there seems to be a shift in the learning style of most university students. The post-pandemic student has a much shorter attention span, and a typical lecture-style environment does not tend to hold their focus (Sim, Sim, & Quah, 2021). In a study conducted by Sim, Sim, and Quah in 2021, students were found to be much more comfortable in the online environment than they were pre-pandemic. Several studies in the last two years show that most university students prefer having at least a portion of their classes to take place online whereas only 18% want fully face-to-face classes (Sim, Sim, & Quah, 2021). These data points create a clear issue for some brick-and-mortar schools and institutions as well as the towns they reside in since they count on face-to-face students for survival. Providing learning opportunities where students can actively interact with the learning content is one of the practices that can be used in the face-to-face classroom to bring back students into the classroom.

Active learning is about active participation by the students in the lesson (Weltman & Whiteside, 2010). This form of learning has been used in many STEM subjects from the k12 classroom through higher education (Weltman & Whiteside, 2010). However, active learning is not the solution to increase test scores overall as found by Weltman and Whiteside (2010). And even though this technique is not perfect for all students, it is important to notice that an active learning approach to specific topics can provide students with a hands-on experience that may help the understanding of the material. This has proved to hold true for math-oriented classes such as statistics (Amoo et. al., 2000; Carlson & Winquest, 2011; Gnanadesikan et. al., 1997; Weltman & Whiteside, 2010).

Researchers have presented multiple active learning lessons and positive outcomes over the last twenty years (Amoo et. al., 2000; Carlson & Winquest, 2011; Gnanadesikan et. al., 1997; Weltman & Whiteside, 2010). While student attitudes toward introductory statistics are not always positive (Prabhakar, 2008), most given the opportunity to teach this type of course would like to see this change (Prabhakar, 2008). More student involvement in the lesson and less lecture format could help the attitudes of the students towards introductory statistics classes (Prabhakar, 2008). Active learning activities tend to have a positive effect on students with lower math aptitude but do not always show a benefit to those with a higher math aptitude (Prabhakar, 2008; Weltman & Whiteside, 2010). Some of this has been attributed to attitudes of higher achieving students that these activities are time wasters or unnecessary (Weltman & Whiteside, 2010).

In the course discussed in this research, the material is presented first in a traditional way with lectures conducted by the professor accompanied by a slide presentation. After the traditional presentation, the professor conducted an active learning component that provided the students an opportunity to interact with the content. This addition of the active learning component was

introduced as an attempt to increase student understanding of the content presented. Many topics in introductory statistics can be easily converted to an active learning lesson. Sampling and the Central Limit Theorem (CLT) was the choice for this course.

Materials and Methods

During the 2021 Fall semester, an active learning activity was conducted in the introductory business statistics course at a small four-year regional university. This activity was used to demonstrate sampling and the Central Limit Theorem using different flavors and the associated colors of a specific type of candy (Starburst). This activity has already been completed in several sections and previous semesters in the face-to-face sections of the course. Normally, in the fall semester, two sections of the business statistics course are taught in a face-to-face, presential, format with up to 30 students in each section and a minimum of two sections taught 100 % in an asynchronous online format with different number of students in each section but almost always over 30 students per section.

As mentioned previously, the active learning activity is conducted using Starburst candy flavors. The regular candy flavors that happen in an original Starburst bag are Cherry, Lemon, Orange, and Strawberry. These flavors are also identified by their color red for Cherry, yellow for Lemon, orange for Orange, and pink for Strawberry. In the commercial market, consumers can purchase original Starburst in various packaging sizes. These sizes range from a 2.07 oz 12-piece stick to value-size bags of up to 50 ounces or more. Many different seasonal packages, with different packaging, flavors and combination of flavors are offered during various holiday periods throughout the year. For the active learning activity designed for the classroom, the instructor acquired several bags of either 48-ounce or 50-ounce of regular Starburst candy with the basic four flavors.

Active Learning Activity Set Up

For this active learning activity, the instructor of the course divided the attending students into groups of 6 to 8 students. The set up selected was facilitated by the layout of the classroom where the activity was conducted. In this case, the students were attending class in a computer lab with 33 workstations, long tables, and rolling chairs. Students can move freely side-to-side to join classmates around the workstations and set up a group space to conduct the activity. The instructor issued a 48 oz or 50 oz bag to each group. Depending on the nature of the class makeup and the facilities in other institutions, the instructor decides how to divide the classroom into groups. Replication of this activity will take into consideration the number of students and the make-up of the groups. These can be easily modified based on the specifics of each institution or classroom location and classroom set-up.

Pre-Activity

To introduce the activity to the students, the instructor displays a tabulation spreadsheet created in Excel that indicates on the top row, each flavor of Starburst and the number drawn for each respective sample and the entire population (n = 8, n = 16, n = 30, and N = TBD). The instructor also provides each group with a paper copy of the template. An electronic copy of the template is uploaded to the Learning Management System (LMS – Moodle) for the students in the sampling chapter topic. Students are given several instructions prior to the start of the actual activity. They are asked to work collaboratively to decide upon a team name, appoint a transcriber, and select a reporter to communicate each count's results to the instructor. From this point forward, the respective teams begin to perform the specific active learning activity tasks.

Activity Tasks

The instructor provides the following instructions to each individual group. Groups are required to complete all four tasks. The tasks to be completed are as follows:

1. Draw a random sample of n = 8 and record the number of candies by color in the template. Using Excel, compute the relative frequency and record it in the template.
    a. Return sample to bag of candies
2. Draw a random sample of n = 16 and record the number of candies by color in the template. Using Excel, compute the relative frequency and record it in the template.
    a. Return sample to bag of candies
3. Draw a random sample of n = 30 and record the number of candies by color in the template. Using Excel, compute the relative frequency and record it in the template.
    a. Return sample to bag of candies
4. Count all candies by flavor/color and using Excel, compute the relative frequency and record it in the template.

As stated in the task instructions, students are asked to utilize Microsoft Excel to compute all calculations during this active learning activity. This is not a new tool for the students as all calculations, previous and current, during the duration of the course are performed using Excel as the tool selected for the tasks.

As an addition to the activity, and to increase the student's engagement and participation in the learning activity, students are given a humorous talk about participant mortality. In this specific case, participant mortality refers to "do not eat the candy" until the activity is complete. If the opportunity arises, and candy falls off the table, the instructor will call a code "red" and come to the rescue to resuscitate the participant so that the candy can be put back into the pool. This is, generally, very well-received by the students.

During the activity, the instructor may choose to complete the classroom-displayed tabulation sheet with one group's information or choose several groups for the different counts. There is a possibility as well to show the students the different results in combined graphs that can be produced live as the students are providing the results of the active learning activity. Once all groups have completed the activity and the results have been received and tabulated by the instructor, findings are discussed. Specifically, the instructor focuses on the different results by group, the uniformity of the samples, the different results between sampling size, and any "surprises" that may have happened during the duration of the activity. Students are asked to verbalize the differences observed with the results of their own group and the other groups participating in the activity as the instructor guides the students to use the active learning activity to better understand the Central Limit Theorem.

Extension of the Activity

Once this active learning activity has been completed for several consecutive semesters, it would be beneficial to show students the different results that have been compiled previously. This presentation of results can be completed as a pre-activity to exemplify what is expected, as a post-activity, to compare the current results to the previous semester's aggregated results and finally as a closing, where students would be asked to add their counts to the aggregated results to get them ready for future semesters. In some of these activities, and for statistical purposes, a Chi-Square (χ^2) Test for Goodness of Fit may be utilized to determine if there is a significant difference between expected and observed frequencies. While this test may not be conducted by the students during the activity, it may be beyond the scope of an introductory statistics course, the instructor can present the test to demonstrate the distribution of the flavors in the current activity versus the aggregated counts and the actual bag population.

Results

In the Fall 2021 semester, the introductory business statistics course was taught in two delivery modes. Two sections (n = 46) were taught in a 2-day-a-week face-to-face format, and two sections (n=58) were taught in an asynchronous online environment. Students in both delivery modes had access to the same resources in the learning management system. Students in the face-to-face sections were provided lecture and application practice in the classroom for each class period. The face-to-face students also had the opportunity to participate in the Starburst candy sampling exercise.

A unit assessment, including the chapter in which sampling was conducted and taught, was administered. Students completed two components of the assessment. They will be referred to as "Exam 2" for the first component and "Excel file upload" for the second component. Exam 2 was a multiple choice, true/false, and worksheet completion exam set up in the electronic courseware. There were twenty total questions on the exam. The first seventeen questions were either multiple choice or true false pulling from a defined pool. The last three questions were worksheet in nature where students had to input numerical values calculated using Microsoft Excel for the Excel file upload component. The Exam 2 portion of the assessment was worth sixty-five points, and the Excel file upload was worth thirty-five points.

An analysis was conducted to determine if there was a significant difference between the student's performance on the unit assessment including the chapter in which sampling was conducted and taught. Since the assessment was developed and graded as two separate units, the analysis was performed in each component.

An independent t-test was performed to determine if students in the online course scored significantly different than those in the face-to-face course on Exam 2. A significant difference was

found, t(100) = -4.84, p < .05. The students in the online courses (*M= 33.79, SD = 16.21*) scored significantly different than those students in the face-to-face courses (*M = 48.09, SD 12.96*).

Table 1. *Independent t-test for difference in Exam 2 scores based on delivery mode*

Group	*n*	*M*	*SD*	*t*	*p*
Online	56	33.79	16.21		
Face-to-face	46	48.09	12.96	-4.84	<.05

An independent t-test was performed to determine if students in the online course scored significantly different than those in the face-to-face course on the Excel file upload for this unit assessment. A significant difference was found, t(100) = -4.38, p < .05. The students in the online courses (*M= 15.23, SD = 12.18*) scored significantly different than those students in the face-to-face courses (*M = 25.67, SD 11.74*).

Table 2. *Independent t-test for difference in Excel file upload scores based on delivery mode*

Group	*n*	*M*	*SD*	*t*	*p*
Online	56	15.23	12.18		
Face-to-face	46	25.67	11.74	-4.38	<.05

Discussion and Conclusion

Comparing the exams for the online and face-to-face students did show a significant difference in scores. It could be concluded that the active learning lesson gave the face-to-face students a deeper understanding of sampling. The scores on the exam could also be attributed to instant access to the instructor in the face-to-face classroom as well as the mode of delivery. Future plans are to look at semesters where the instructors in the face-to-face classroom were different and one delivered the starburst lesson, and the other did not. This should assist to clarify the effect of the active learning lesson and student scores on the exam. Furthermore, finding a way to deliver the lesson to online students and having them present their findings in an assignment to see if this improves their scores on the exam.

Continuing activities with something familiar to the students may increase understanding as concepts build throughout the semester. An extension of this activity would be to utilize Starburst candy in the normal distribution and probability lessons. Sampling questions directly related to the starburst activity could be added to the test bank questions for this unit. Further research could also be done on what type of learners learn best with active learning lessons.

The chapter covering sampling falls just after midterm, in a typical fall semester. This activity was well received by students to boost morale. This light-hearted activity with a strong lesson helps build confidence and relaxes students. It is entertaining to watch the bartering and bargaining for favorite flavors. Also, to see which flavor is left all by itself for the instructor to dispose once all the students have taken their pick. Students are most gracious when they are told at the end of the less the candy is theirs to keep.

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From Crisis to Cloud: Insights from a Crisis-Driven Digital Transformation using CCAAS

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Abstract

This paper explores the digital transformation of Coast Capital, a Canadian credit union, focusing on its transition from a premises-based system to a cloud-based model during the COVID-19 pandemic. The study emphasizes the utilization of a cloud-based contact center as a service solution (CCaaS) for modernizing operations and improving structural flexibility. The findings offer insights into the benefits, challenges, and strategic implications of digital transformation and CCaaS adoption, particularly for financial institutions in disruptive circumstances.

Keywords: digital transformation, CCaaS, SaaS, technology implementation

Introduction & Background

In March 2019, the unprecedented COVID-19 pandemic precipitated stringent government regulations in many countries, mandating non-essential workplaces to enforce social distancing measures and curtail in-person interactions. This situation posed a formidable threat to the operational efficacy and profitability of numerous organizations, including Coast Capital, a prominent provincial credit union situated in southwestern Canada. Coast Capital provides an array of financial services, encompassing banking, investments, insurance, and lending, to its clientele in British Columbia. Confronted with the imminent risk of insolvency due to its hindered capacity to maintain efficacious communication and service provisions to its clients, Coast Capital resolved to undertake a partial digital transformation by embracing Contact Center as a Service (CCaaS) technology and transitioning to a remote work paradigm.

The implementation of CCaaS technology facilitated the credit union's ability to not only withstand the pandemic's adverse effects but also to enhance its service offerings. Moreover, this technological adoption primed the organization for future expansion and fortified its preparedness against potential crises. The integration of CCaaS technology enabled Coast Capital to sustain remote operations while preserving effective communication channels and delivering exceptional service to its clientele.

CCaaS

CCaaS, short for Cloud Contact Center as a Service, is a cloud-based software application designed to manage contact centers. These providers offer application integrations and standardize platforms across organizations, thereby enhancing the capabilities of customer service departments. This standardization allows for exceptional service delivery across the four pillars of exemplary customer service. Utilizing this technology, agents gain a unified view of customers, experience enhanced collaboration, and can track performance more effectively. They can also communicate through various channels, including phone calls, text messages, email, and social media (DiNardi, 2021). As a Software as a Service (SaaS) solution, CCaaS reduces the need for in-house IT resources while providing quick scalability and geographic flexibility. In line with the growing adoption of cloud-based services, particularly among remote workers, the global CCaaS market is expected to expand from $4.87 billion in 2022 to $15.07 billion by 2029 (Contact Center, 2022). Amid crises like the COVID-19 pandemic, cloud contact center technology can play a critical role in helping organizations adapt and thrive.

The expanding popularity of the CCaaS market can be attributed to the convenience and flexibility inherent in cloud-based solutions. CCaaS providers present a plethora of features,

including chatbots, interactive voice response (IVR), and workforce management tools designed to enrich customer service experiences. Additionally, the cloud-based nature of CCaaS solutions facilitates seamless access and collaboration between agents and customers, irrespective of their geographic location. By adopting CCaaS technology, organizations stand to reap substantial benefits, such as cost reduction, heightened scalability, and location flexibility, all while delivering exceptional customer service.

As organizations worldwide were compelled to acclimate to remote work in response to the COVID-19 pandemic, the demand for cloud-based contact center technology became increasingly evident. CCaaS technology enabled enterprises to seamlessly transition to remote work arrangements without compromising the quality of customer service. As businesses continue to navigate an ever-changing global and digital landscape, the adoption of cloud-based technologies like CCaaS is expected to keep expanding.

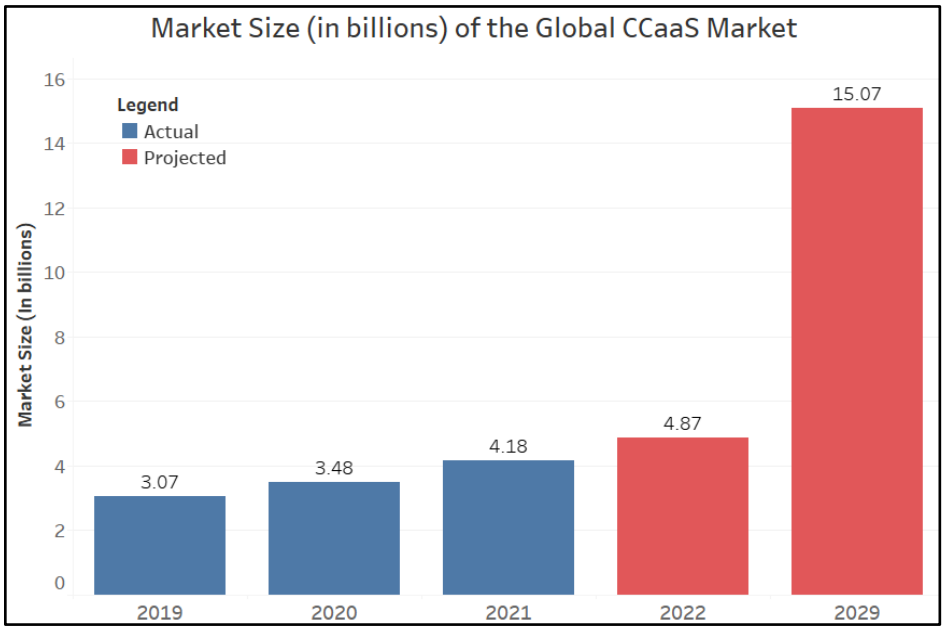

Figure 1: The market size—both historical and projected—of the global CCaaS market (adapted from data provided by *InterVision* and *Fortune Business Insights*).

Overview of Coast Capital in the Crisis

The financial sector has traditionally been characterized by brick-and-mortar establishments; however, technological advancements and recent global events, such as the COVID-19 pandemic, often compel banking institutions to increasingly adopt and innovate digital solutions. Coast Capital represents one such organization, whose service offerings were considerably impacted by the pandemic. Initially, Coast Capital functioned as a provincial credit union situated in southwestern Canada, proffering financial services encompassing banking, investments, insurance, and lending to its clientele in British Columbia. In 2018, the credit union acquired a national banking license, thereby enabling them to broaden their market reach. Nevertheless, Coast Capital's technological infrastructure at the time proved inadequate for delivering requisite services to its newly expanded and geographically dispersed customer base. Their legacy systems and technology were rigid and unreliable, consistently failing to meet the diverse needs of their customers. Furthermore, the majority of their physical facilities were located in close proximity to a fault line, rendering their data—which was stored on-premises—vulnerable to significant risks. Consequently, it became increasingly evident that a transition from premise-based technology to cloud-based solutions was imperative to fulfill the organization's burgeoning demands.

In early 2019, Coast Capital embarked upon a digital transformation. Digital transformation refers to the integration of digital technologies into various aspects of businesses, including combinations of information, computing, communication, and connectivity technologies (Vial, 2019), often fundamentally changing how companies operate and deliver value to their customers

(Bharadwaj et al., 2013). For Coast Capital, this took the form of selecting a CCaaS vendor and developing a cloud-based, digitally implemented solution.

However, shortly after the initial launch of the digital contact center, the COVID-19 pandemic struck, obliging the organization to comply with government regulations that restricted the number of individuals permitted within a single physical location. Given that Coast Capital employed 165 individuals at their call center, adhering to this guideline presented a formidable challenge. Prior to fully transitioning their workforce to remote work, Coast Capital dispersed their employees across seven distinct locations. Owing to their newly implemented CCaaS solution, the organization could effectively monitor and support their employees while concurrently adhering to the safety guidelines mandated by the government of British Columbia.

In addition to the regulatory challenges arising from the pandemic, Coast Capital experienced a 158% surge in call volume due to customer inquiries related to COVID-induced payment deferrals and government support programs. The organization's existing infrastructure proved incapable of managing the influx of calls, and its employees grappled with elevated levels of burnout and turnover due to the emotionally charged nature of the calls. To address the situation, Coast Capital expanded its workforce by 25%, established online self-service forums, and engaged standalone groups to manage the forums. The training of 85 new employees was expedited through the utilization of CCaaS technology.

After undergoing several iterations of the CCaaS technology, Coast Capital discovered a solution that ameliorated many of the issues associated with their geographically dispersed financial and customer services. This expeditious digital transformation of their call center allowed Coast

Capital to accommodate the increased call volume, assist customers regardless of their geographic location, and train employees remotely with enhanced efficacy.

Coast Capital's digital transformation journey offers valuable insights and serves as a model for other organizations facing similar challenges. A comprehensive analysis of the steps undertaken by the company is presented in the subsequent sections, enabling readers to understand and potentially apply these strategies to their own digital transformation initiatives.

Coast Capital's Digital Transformation

Using a three-step process, Coast Capital adeptly facilitated a transition from on-premises to remote work. The implementation of the CCaaS solution encompassed three pivotal phases:

1. Analyze CCaaS vendor alternatives
2. Build and iterate the technological solution
3. Implement the solution and train employees

Step 1: Analyze Alternatives

To begin the digital transformation process, Coast Capital conducted a thorough analysis of the costs and benefits of a CCaaS model. With their banking services expanding nationwide, their in-house technology no longer sufficed to accommodate the needs of their geographically disparate client base. However, the advent of the pandemic rendered it crucial for Coast Capital to possess the capacity to transition their workforce to remote work. Consequently, the organization resolved to implement a CCaaS solution.

To ensure a successful implementation, Coast Capital embarked on a meticulous and comprehensive vendor selection process. The organization sought a CCaaS provider that not only

offered flexible and scalable technology but also demonstrated a steadfast commitment to forging a long-term partnership. This would ensure that the chosen solution would be able to adapt to Coast Capital's evolving needs while remaining responsive to industry changes and emerging trends.

To facilitate this process, Coast Capital convened cross-functional groups, including representatives from information technology, customer service, and management, to deliberate on requirements and establish a clear set of objectives for the CCaaS solution. This collaboration ensured that the perspectives and needs of various stakeholders within the organization were considered, fostering a more effective and comprehensive decision-making process. Subsequently, Coast Capital turned to the Gartner Magic Quadrant for CCaaS vendors, a reputable industry resource, as a starting point for identifying potential providers (Gartner). This resource allowed the organization to gain insight into the relative strengths and weaknesses of the various vendors in the market, as well as their overall positioning in terms of ability to execute and completeness of vision. Armed with this knowledge, Coast Capital proceeded to interview numerous vendors from the list, assessing their capabilities, experience, and alignment with the organization's specific requirements. During these interviews, Coast Capital evaluated each vendor's track record, customer support services, and overall strategic vision to ensure that the chosen provider would be a reliable and valuable partner in the long run.

Ultimately, NICE CXone's CCaaS platform emerged as the ideal solution, capable of fulfilling Coast Capital's stringent criteria by providing the essential features, robust security, and flexibility requisite for their unique circumstances. The selection of NICE CXone demonstrated Coast Capital's commitment to a thorough and well-informed decision-making process, ultimately contributing to the successful implementation of their digital transformation strategy.

Step 2: Craft the Solution

Coast Capital embarked on a scrupulous and systematic process of devising and implementing a cloud contact center solution tailored to their unique requirements and organizational objectives. After entering a strategic collaboration with Nice CXone in early 2019, Coast Capital worked with their new partner to thoroughly examine the software options that would be optimally suited to address their needs and enhance their service capabilities. During this collaborative phase, Coast Capital and Nice CXone engaged in an iterative process of exploring, refining, and customizing various features and functionalities to ensure that the final solution would not only meet their current needs but also provide a solid foundation for future growth and adaptation.

Upon the completion of the solution's development, Coast Capital undertook the critical task of migrating their existing data to the new cloud-based application. This process was executed with meticulous attention to detail, ensuring the integrity and security of the data throughout the migration. Subsequently, Coast Capital conducted a series of rigorous tests to ascertain the success of the data migration and verify the functioning of the solution in diverse scenarios and under various loads. This process culminated in the launch of the innovative solution at the close of November 2019, marking a significant milestone in Coast Capital's digital transformation journey.

The crafting of a tailored solution constitutes an integral component of any triumphant digital transformation initiative. By forging close collaboration with a vendor, organizations can not only explore diverse options but also benefit from the vendor's expertise and experience to pinpoint a solution that best aligns with their specific requirements. Furthermore, it is imperative to ensure that data is accurately transferred to the new system, and that the solution operates with relative efficacy

prior to its official launch, thereby mitigating potential disruptions and facilitating a smooth transition for both employees and customers.

Step 3: Implement the Solution & Train Users

Coast Capital's digital transformation journey encountered its share of obstacles, particularly as the pandemic unfolded. Following the implementation of the new solution, Coast Capital employees initially grappled with adapting to the novel system's operations. However, with escalating concerns surrounding COVID-19 and government regulations, Coast Capital had to swiftly learn and deploy its new system to guarantee business continuity while also safeguarding employee health. Despite initial apprehensions about transitioning to a remote model, Coast Capital's IT team, in collaboration with CXone consultants, diligently addressed technical issues related to the new system's networking. The team's perseverance yielded results, and after eight days of troubleshooting, a viable solution emerged. Coast Capital subsequently dispersed its workforce, accomplishing the transition to remote work within approximately thirteen days. Despite initial technical impediments, Coast Capital's successful implementation of its new system empowered the company to navigate the challenges presented by the pandemic, including transitioning 165 full-time employees from in-office to remote work, diminishing absenteeism to less than two percent, and sustaining customer support and satisfaction.

In addition to implementing an efficacious solution, one of Coast Capital's paramount priorities was offering comprehensive support to employees and fostering a sense of connection and camaraderie within the newly adopted, distanced work environment. The significance of providing such training and support cannot be overstated, as remote work poses distinct challenges for both

employers and employees, including communication hurdles, time management difficulties, and potential isolation, among others.

Recognizing these challenges, Coast Capital proactively sought to equip their employees with the necessary tools, resources, and guidance to navigate the new remote work landscape successfully. This approach involved leveraging the expertise and resources provided by the SaaS vendor, which included tailored training modules, best practice guidelines, and ongoing support services designed to facilitate a smooth transition to remote work.

Moreover, Coast Capital placed a strong emphasis on promoting open communication, feedback, and collaboration among employees, ensuring that they felt heard, valued, and supported throughout the transition process. This focus on employee engagement and well-being not only contributed to their confidence and ability to execute their duties remotely but also fostered a sense of unity and shared purpose within the workforce.

By adopting a holistic approach to employee support, Coast Capital not only successfully navigated the challenges associated with remote work but also cultivated a resilient, adaptable, and highly motivated workforce, prepared to face the uncertainties of the digitally-transformed work environment.

Benefits of CCaaS

Coast Capital's adoption of a digitally transformed solution for their contact center services yielded numerous advantages. Primarily, the solution facilitated the organization's ability to capture more data, which could be harnessed for informed decision-making. With heightened visibility into customer interactions, Coast Capital was able to discern patterns and make data-driven decisions to optimize their contact center operations. This augmented data capture furnished valuable insights

into customer needs, preferences, and behaviors, empowering the organization to customize its services to better address customer demands.

Secondly, the implementation curtailed downtime for employees, resulting in enhanced productivity and efficiency. By offering a centralized system, customer service became more streamlined, enabling employees to effortlessly access information and resources to better serve customers. This led to expedited resolution of customer inquiries and issues, diminishing customer wait times and augmenting overall satisfaction.

Moreover, the implementation could be integrated with other services, allowing for a unified experience across all channels of interaction. This integration of services contributed to greater ease of use for customers and employees alike, as well as increased efficiency and productivity. Ultimately, these benefits underscored the value of a digitally transformed contact center solution in ameliorating overall operations and enriching the customer experience, culminating in heightened customer loyalty and retention.

Broader Implications of Digital Transformation in the Financial Sector

The experience of Coast Capital's digital transformation highlights several broad yet salient implications for the financial industry that merit examination. The intensification of competition has become apparent. For example, the adoption of digital technologies by institutions like Coast Capital has catalyzed heightened competition within the financial sector as traditional banks confront challenges posed by fintech companies and neobanks, which offer inventive, client-focused solutions. To remain competitive, banks must allocate resources to the development and implementation of state-of-the-art technologies while persistently refining their digital offerings (Deloitte, 2020).

Additionally, as technology continues to advance, customer expectations undergo a parallel evolution. With the increasing adoption of digital transformation by financial institutions, including Coast Capital, clients anticipate more streamlined, customized, and expedient experiences. Consequently, banks must acclimate to these shifting expectations by providing a diverse array of digital services, accessible via multiple channels and tailored to the specific requirements of their clientele (Deloitte, 2020).

Furthermore, the need for perpetual innovation in the financial sector has become essential. The accelerated pace of technological advancements mandates constant innovation in the financial sector. In order to maintain a competitive advantage and elevate customer service, banks, such as Coast Capital, must remain vigilant of emerging technologies, such as artificial intelligence, blockchain, and big data analytics, and integrate them into their operations (PwC, 2019). The overarching ramifications of these trends necessitate strategic adaptation and innovation, thereby ensuring the financial industry's continued growth and resilience in a rapidly evolving landscape.

Conclusion

Coast Capital's successful execution of cloud-based contact management technology, utilizing a comprehensive three-stage process, facilitated their adaptation to the multifaceted challenges engendered by a global pandemic. This process encompassed an initial phase of thorough planning, which incorporated an evaluation of the organization's requirements and proficiencies, succeeded by an implementation methodology, and ultimately, culminating in perpetual monitoring and optimization. This strategic approach enabled Coast Capital to adeptly transition a workforce of 165 full-time employees from traditional office environments to remote work arrangements, concurrently reducing employee absenteeism. By embracing a cloud-centric solution, the

organization was enabled to persistently deliver exceptional customer support and maintain elevated levels of customer satisfaction.

Coast Capital's exemplary digital transformation serves as a framework for other organizations endeavoring to acclimate to fluctuating market conditions or crises. By adopting a structured approach to digital transformation, organizations can effectively mitigate disruptions to their operations and optimize outcomes. In addition to the manifold advantages of remote work and diminished absenteeism, the deployment of cloud contact management technology can enhance service quality, augment efficiency, and facilitate superior data collection and analysis for more informed decision-making. These substantial benefits underscore the imperative nature of digital transformation within the contemporary, fast-paced, and perpetually evolving business landscape.

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CompTIA ITF+ Certification in an Introductory CIS course

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Abstract

This paper provides an analysis of the results obtained from the CompTIA Information Technology Fundamentals (ITF+) certification examination, taken by students enrolled in the Introductory to Computer Information Systems (CIS 1015) course at Northwestern State University (NSU). The research focuses on the passing percentages of students who took classes in a traditional face-to-face classroom setting and those who took classes online in an asynchronous format during Fall 2022. This study aims to evaluate the efficacy of the two course delivery modalities in preparing students for the ITF+ certification by comparing and contrasting the performance of the two groups.

Keywords: CIS, CompTIA, ITF+ certification, passing rates, course delivery method, face-to-face class, online class.

Introduction

Computer Information Systems (CIS) is an ever-evolving and dynamic discipline of critical significance in today's technology-driven society. CIS has become crucial to nearly all industries by using technology to collect, analyze, store, and distribute data, helping businesses increase productivity, reduce waste, and maintain a competitive edge (*What is an information system?,* 2022).

Continuous advancements in hardware, software, networking, and data analytics have been the primary forces behind the accelerated growth of CIS (Scharre, 2017). As new technologies are constantly being developed, information security professionals must stay abreast of recent trends, tools, and techniques; only then will they be able to effectively handle any issues that may occur as a result of these advancements and fully benefit from the potential these technologies provide (Subhani, 2021). Certifications in information technology play a vital role in ensuring that professionals remain current with the rapidly evolving technological environment, enabling them to maintain their competitive edge and value in the rapidly developing field of information technology (Tannian, 2021).

This paper aims to analyze the value of the CompTIA ITF+ test within the context of Northwestern State University's Introduction to Computer Information Systems course, CIS 1015. The report will examine the benefits of incorporating this certification into the curriculum and evaluate the Fall 2022 semester pass rates of face-to-face and asynchronous online students. The objective is to compare and assess the performance of these two groups to determine the efficacy of the course delivery methods in preparing students for the ITF+ certification. The study's conclusions will give helpful information for boosting teaching strategies and raising student results in CIS 1015

and related courses by delivering insights into students' success rates and possible concerns in various instructional formats.

Background and Prior Research

In recent years, the significance and popularity of IT certifications have experienced substantial growth. Esteemed IT publications such as Computerworld, Certification, and NetworkWorld have highlighted the advantages of IT certifications, including their potential to enhance employability, promotion prospects, and salary for candidates (Arora, n.d.; Bort, 2011; Gablehouse, 2002). Numerous research studies consistently demonstrate that obtaining an IT certification distinguishes oneself from other job applicants, showcases proficiency in up-to-date skills, and makes a positive impression on hiring managers and potential employers (Hunsinger & Smith, 2005; Robin, 2011; Wireschen & Zhang, 2010). Acquiring an IT certification not only sets individuals apart but also validates the currency of their skills, often resulting in higher salaries and gaining respect and credibility among colleagues and employers.

In addition to their degree, many recent IT graduates recognize the significance of practical experience, which can be challenging for those without work history. Moreover, there is a prevailing belief that having an IT certification can enhance the opportunities for new graduates by capturing the attention of HR managers (Hunsinger and Smith; Robin; Wireschen & Zhang). A survey highlighted in NetworkWorld magazine revealed that 60% of 700 network professionals secured new job opportunities, and 50% experienced increased earnings after acquiring IT certifications (Bort). Another article in Certification magazine emphasized the sense of professional security felt by certified professionals (Gabelhouse).

The relationship between certifications and education and between certifications and experience is a widely debated topic. Bartlett (2002) suggests that individuals without formal education may encounter limited career opportunities and short-lived employment in the IT workforce. Adelman (2000) argues that certifications generally do not replace experience or traditional education degrees. On the other hand, some question the value of higher education and advocate for alternative paths, such as professional certifications. Zeng (2004) emphasizes that certified professionals meet the necessary criteria and are considered professionals, regardless of possessing a college degree. Several researchers, including Peslak (2005) and Randall et al. (2005), recognize the complementary nature of IT certifications and formal education, arguing that education alone is insufficient for developing complete professional capabilities in the IT industry.

The Value of IT Certifications in Hiring Practices

Extensive literature delves into the value of IT certifications in the hiring practices of IT professionals. Although IT certifications do not completely replace education or experience, according to CompTIA, 96% of hiring managers consider IT certifications to be a medium to high priority during candidate evaluations. Additionally, 91% of hiring managers state that certification is a part of their hiring criteria (Microsoft Learning). The study by Hunsinger and Smith explores the factors influencing a hiring manager's decision to utilize IT certification in employee selection. Their findings indicate that managers sometimes use certifications to differentiate between candidates with similar educational backgrounds and experience levels. Certifications serve as benchmarks for assessing competency in specific areas and job roles (Al-Rawi, Bouslama, & Lansari, 2006). They enable the IT industry to verify that employees possess the necessary qualifications for various job roles, ultimately reducing training requirements during the initial employment period. From an individual perspective, certifications instill greater confidence in one's abilities and measure

professional expertise and comprehension of job roles and relevant products. As a result, certifications are experiencing increasing popularity and demand.

Computer Information Systems Degree

At Northwestern State University (NSU), located in Natchitoches, LA, the Computer Information Systems (CIS) program provides an extensive curriculum that leads to a Bachelor of Science degree in CIS. To cater to the diverse needs of students, all CIS courses at NSU are available in both asynchronous online and face-to-face formats. Because of this flexibility, students in the CIS degree program are given the opportunity to choose the form of learning that is most suitable to both their preferences and their schedules. As a result, it is easier for them to keep up with their studies.

The curriculum allows students to pursue one of four specialized concentrations: Application Development, Networking and Systems Management, Information Systems Management, and Cybersecurity (Northwestern State University, n.d.). Each path is designed to cater to a distinct set of interests and career pathways within the field of CIS.

As a required course for their major, Computer Information Systems (CIS) students at NSU are required to enroll in CIS 1015: Introduction to Computer Information Systems. This course serves as a stepping stone for students interested in entering the information technology (IT) industry by providing a thorough introduction to the field. Furthermore, CIS 1015 assists students in identifying their desired focus within the CIS program by introducing them to various concentration options and supporting them in making educated choices about their future studies and careers. By the end of the semester, students will have a better idea of whether or not an IT degree is the right choice for them.

The Incorporation of the Certification Exam

In the CIS program, students may be required to pass certification examinations to fulfill course requirements and earn credit for certain classes. We chose to incorporate the CompTIA Information Technology Fundamentals (ITF+) certification as a necessary component of the Introduction to CIS course to assist students in feeling more at ease during tests and to provide them with experience in a controlled testing environment. By obtaining the ITF+ certification, students gain practical knowledge and skills that align with the course objectives of CIS 1015.

The decision to incorporate IT certifications into the CIS program is supported by research showing their importance to hiring managers. As previously mentioned, managers consider IT certifications significant during candidate evaluations and use them as part of their hiring criteria to differentiate among candidates with similar educational backgrounds and experience levels. These certifications serve as benchmarks for assessing competency in specific areas and job roles, providing the IT industry with a reliable way to verify employees' qualifications and reducing training needs during the initial employment phase.

CompTIA ITF+ Exam

CompTIA, a globally recognized organization, is renowned for offering vendor-neutral IT certifications. CompTIA is committed to empowering IT professionals in navigating our interconnected digital landscape with a remarkable record of issuing over 2 million IT certifications worldwide. The CompTIA ITF+ exam is a comprehensive assessment that assesses candidates' knowledge and proficiency in fundamental computing principles, IT infrastructure, application and Software comprehension, software development understanding, database fundamentals, and security awareness (*CompTIA IT Fundamentals*).

The CompTIA ITF+ exam encompasses a range of domains and topics that candidates must cover:

- IT Concepts and Terminology: illustrating the fundamental principles of computing and data processing.
- Infrastructure: explaining the purpose of common internal computing components and introducing basic networking concepts.
- Applications and Software: understanding software purpose, proper usage, and application architecture methods.
- Software Development: comparing and contrasting programming language categories.
- Database Fundamentals: explaining core database concepts and the overall purpose of a database.
- Security: Detailing methods for securing devices and emphasizing best practices in maintaining a secure computing environment.

Successful candidates who pass this exam will possess the essential skills to:

- Set up a computer workstation and operate basic software applications on a Windows platform.
- Understand the functionality and types of devices used within computer systems.
- Apply fundamental principles of computer maintenance and support.
- Grasp foundational concepts of software and database development.
- Configure computers and mobile devices to establish connections within home networks and the internet.
- Identify and address security issues that impact computer and network usage.

Additionally, candidates validate their proficiency in these domains by successfully passing the CompTIA ITF+ exam, equipping them with a solid foundation in essential IT knowledge and skills.

Exam Preparation

The participants in this study were enrolled in the 16-week introductory CIS 1015 course in Fall 2022. They underwent training using CompTIA materials specifically designed to prepare them for the ITF+ certification. CertMaster Learn is an interactive and self-paced tool that incorporates lessons, assessments, videos, and performance-based questions and offers more than 40 hours of content directly aligned with the exam objectives (*Comptia CertMaster Learn,* n.d.). CompTIA Labs is a remote lab environment designed to align with the CompTIA exam objectives, allowing students to gain hands-on practice with real software applications (*CertMaster Labs,* n.d.). In addition, students have access to the CertMaster Practice online tool, which accurately assesses the student's existing knowledge and identifies areas in which students need extra instruction. Students may improve their readiness for the exam by using this resource, which provides a practice test with questions based on previous performance.

Testing

After completing the sixteen-week semester and all required training and exam preparation, students were able to register for and take the ITF+ certification exam. The exam consists of 75 multiple-choice questions, lasts 60 minutes, and a minimum score of 650 out of 900 is required to pass the exam (*CompTIA IT Fundamentals,* n.d.).

CompTIA ITF+ certification exams are administered by Pearson VUE and may only be taken at authorized Pearson VUE testing centers (*Candidate Testing Policies,* n.d.). In the testing room, test takers are not allowed to bring in any personal items, including bags, books, notes, laptops, tablets, cellphones, or smartwatches (*Candidate Testing Policies*).

During the check-in process for the testing appointment, test takers have their photograph taken, which is a component of the candidate testing policies to enhance security and authentication measures during the exam (*Candidate Testing Policies*).

After the exam, candidates receive a score report that contains important information regarding the outcome of the exam.

Exam Results

The accessible population consisted of the 80 students who enrolled in CIS 1015 at the beginning of the Fall 2022 semester. There were three sections of this course. Two sections were offered in a traditional face-to-face environment. The third section was offered in an asynchronous online format. The sample obtained from this group included n = 68 students who attempted the ITF+ Certification exam as a requirement for credit in the course. The alpha level was set at .05 *á priori*.

The required minimum score to be considered as passing the ITF+ Certification is a score of 650. The exam scores during the Fall 2022 semester ranged from 524 to 863, with the *M = 635.21, SD = 53.10*. Table 1.1 indicates scores by type of course enrolled.

Table 1.1

ITF+ Scores by Type of Course

Type of Course	*n*	*M*	*SD*
Face-to-face	36	622.32	41.89
Asynchronous Online	32	649.69	60.85

The following table (Table 1.2) presents the frequency and percentage of ITF+ scores that were considered passing (≥650) or failing (<650). More students (n = 20) passed the ITF+

certification exam in the asynchronous online section of CIS 1015 than those in the face-to-face (n = 15) sections.

Table 1.2

Frequency and Percentage of ITF+ Scores by Type of Course

Type of Course	Passing Score		Failing Score		Total Students by Type of course
	n	%	*n*	%	*n*
Face-to-face	15	41.67	21	58.33	36
Asynchronous Online	20	62.50	12	37.50	32
Total Pass/Fail	35	100.00	43	100.00	68

To determine if a difference existed between success on the ITF+ Certification Exam based on type of course enrolled in, an independent samples t-test was used to analyze the data. The independent samples t-test comparing the mean scores of those in face-to-face and those in asynchronous online yielded a significant difference as shown in Table 1.3.

Table 1.3

Independent Samples t-test for Differences in ITF+ Scores by Type of Course

Type of Course	*n*	*M*	*SD*	*t*	*p*
Face-to-face	36	622.32	41.89	2.13	.04
Asynchronous Online	32	649.69	60.85		

Discussion of Results

The research obtained a sample of 68 students who attempted the ITF+ Certification exam at the end of a 16-week semester in Fall 2022. The study compared the performance of face-to-face students and asynchronous online students.

For the face-to-face students, the data showed that out of 36 students who took the exam, 15 of them passed, while 21 did not pass, resulting in a pass rate of 41.67% and a failure rate of 58.33%. On the other hand, the results for the asynchronous online students revealed that out of 32 students who took the exam, 20 passed, and 12 did not - which translates to a pass rate of about 62.50% and a failure rate of 37.50%.

The study highlights interesting trends, indicating that face-to-face students had a lower pass rate, raising questions about the effectiveness of the face-to-face teaching method for preparing students for the IT certification exam.

Conversely, asynchronous online students performed relatively better, suggesting potential advantages in terms of exam preparation and performance. The flexibility of the online learning environment may have contributed to this higher pass rate, allowing students to engage more with the ITF+ exam preparation materials.

These findings suggest that the asynchronous online learning environment could be more effective for succeeding in IT certification exams, at least in this specific course. However, it's crucial to consider other factors like teaching methods, exam complexity, and students' prior knowledge. These elements can also impact students' performance and should be considered when evaluating the overall results.

Notably, the pass rates for both groups are not exceptionally high, indicating room for improvement in course content and teaching methodologies. Further analysis of the factors contributing to student success or challenges in each group can offer valuable insights for enhancing the IT certification course.

This study highlights the significance of consistently reviewing and improving teaching methods and resources to support students' learning and enhance their likelihood of succeeding in certification exams.

Implications for Future Research

While it is noteworthy that more online students passed the ITF+ test than face-to-face students, this finding may be better understood by doing more research that delves deeper into this pattern and investigates aspects such as the characteristics of students in both online and face-to-face situations. Additional research into demographic factors such as student type (traditional or non-traditional), current occupation, age, and previous experience in the field may shed insight into the differences in success rates. For instance, the greater pass rate among online students may be due to the larger share of non-traditional students already employed in IT, with practical experience.

Additional variables such as study habits, degree of engagement with course materials, and effect of technical competence might be explored in future research to provide a complete understanding of the factors influencing the academic achievement of online and face-to-face students. Such research would result in a more thorough analysis and provide invaluable insights for developing strategies to improve student outcomes in both instructional formats.

Understanding the effect that student demographics, methods of instruction, and other pertinent factors play will help instructors to improve teaching methods, bridge the gap between diverse student populations, and produce better outcomes for all students enrolled in CIS 1015 and related courses.

Conclusion

This research has provided valuable insights into the effect of various instructional modalities on students' preparation for the ITF+ certification. The outcomes of this study have practical uses for instructors, curriculum developers, and administrators engaged in developing methods of instruction for students earning the ITF+ certification in introductory CIS courses. Educators are better positioned to meet their students' requirements when they are thoroughly aware of the benefits and drawbacks of the various approaches to curriculum delivery. They may then utilize this information to better prepare their students for the ITF+ test and enhance their instruction quality.

Nevertheless, it is essential to recognize that this research is only a small piece of the puzzle. More research is required to investigate additional variables impacting student success in ITF+ certification tests. To better understand student outcomes, variables such as motivation, study patterns, prior experience, and learning styles could be explored further.

The ITF+ certification preparation techniques must undergo continuous development and refining to be effective in various learning environments. Educators must continually evaluate the efficacy of their teaching strategies as technology and educational practices evolve. Further study and assessment will enable instructors to alter and enhance their methods, ensuring students receive the most effective preparation for the ITF+ certification.

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An Analysis of University Social Media Policy Composition and the Creation of a Functional List for Development

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Abstract

In contrast to traditional communication and technology policies, groundwork for social media policies does not often exist, meaning their content and structure may vary widely among institutions. This qualitative study investigated the composition of existing social media policies and how they relate to theory. We analyzed and coded a sample of social media policies (N=32) that resulted in a list of components in the areas of policy focus and overview, university image, account creation and maintenance, and posting. The findings provide a foundational list from which to build personalized, university-specific social media policies to guide developers in appropriate and effective use of this engaging and popular tool.

Keywords: social media, policy, university, communication

Introduction

Communications policies are a common staple of places of employment today (Lenartz, 2012). These policies regulate employees' communication activity within, as well as about, an organization. Universities typically have longstanding general communications policies in place, having been developed and revised over many years as integral components in strategic management. In the past decade, social media has emerged as an additional, important tool in university communications (Pomerantz et al., 2015). Because social media is an important and comparatively new tool for universities, the content and structure of these policies may vary widely among institutions.

In this paper, social media is defined as "any social networking site that has users develop an online profile and promote interaction through a network of peers using messages, photos, or videos" (Pham, et al., 2014, p. 133). Social media has transitioned from a personal-use only communications tool into a widely accepted professional communications tool with many higher education institutions using it to communicate with students, enhance course curricula, and reach future students. Additionally, because roughly 70% of adults use some form of social media today (Pew Research Center, 2021b), university faculty and staff members' personal usage of social media is important to consider, as well, when creating institutional policies.

Portable devices that enhance connectivity have become very common, easing the way for educational social media usage. Ninety-seven percent of university faculty members reported owning at least one of the following types of technology: laptop, tablet, or smartphones (Brooks, 2015), and that figure has surely increased in the years that followed. Today, 97% of U.S. adults reported owning a cell phone with 85% owning a smart phone (Pew Research Center, 2021a). This widespread usage of mobile devices is supported by research published by the Radicati Group, Inc.

(2019), which stated that mobile device users would increase from 6.8 billion users in 2019 to 7.3 billion users in 2023; additionally, researchers predict an average of 2.29 mobile devices per person in 2023.

While institutions may have communications policies or computer usage guidelines, it is important that these policies be revisited and expanded to include the latest technologies, such as social media (Bernard, 2010). Many universities are implementing standalone social media policies today, which serve to "(1) support usage that leads to positive outcomes, (2) intervene to help students whose technology has caused or may cause negative outcomes, and (3) intervene to help students who are at the receiving end of negative social media behavior" (Junco, 2011, p. 60). University employees have been charged with not only interceding in cases of negative social media outcomes but have also taken on the role of teaching and encouraging constructive and responsible use of this communication tool.

Because social media communication is instant, widely available, and blurs the lines of information and formal messaging, its management and regulation can pose unique challenges for policy makers. Traditional communications policies contain a set of time-tested and commonly accepted elements, related to items such as sensitive content, harassment, and privacy, but managing social media communications is a much more recent endeavor. In this paper, we analyzed the literature related to social media policy development and the components of current university social media to develop a list of integral elements for policy developers and managers. A review of the literature provides the context for the analyses that follow.

Literature Review

We reviewed areas of literature related to the transition to social media in the workplace, adoption and awareness of social media policies, the development process of social media policies,

and the composition of social media policies in the university setting. While general communications and conduct policies have existed as integral institutional governance components for some time, technological innovations require revisions to and sometimes replacements of existing policies (Eisler, 2001). With student, staff, and faculty roles evolving to include digital tools, dedicated policies to govern appropriate use are justified (Woodley & Silvestri, 2014).

Transition to Social Media

To best understand social media policy development, we explored the evolution of related topics, such as overall communication policies. Reinard and Ortiz (2005) analyzed 503 studies related to communication law and policy between 1996 and 2004 and found that the most studied topics were (a) "general regulation of mass media," and (b) "communication on the Internet" (p. 602). A great interest in online communication indicated not only an increased use of Internet communication in recent decades, but also the increased importance of studying matters related to online communications, including social media channels.

Undoubtedly, the definition of online communications is changing and will continue to do so. While decades ago, policy developers encountered email and cell phones as the new channels, today email usage has become commonplace (and commonly managed), with 376 billion business and consumer emails expected to be sent and received per day by 2025 (Radicati Group, 2021), and cell phone usage has nearly overtaken landline office phone usage. As these channels age and social media increases in popularity, the need to ensure social media's ethical, legal, and effective use in the workplace gains importance.

Social Media Policy Adoption and Awareness

Social media policy implementation is not universal, with research suggesting that university social media policies exist in a variety of forms (Timm & Duven, 2008; Creque, 2010; Pham et al.,

2014; Karpman & Drisko, 2016; Pasquini, 2016). Sometimes, institutions do not have policies at all, or policies exist but their existence is not commonly known. In a survey of psychology program faculty and graduate students, researchers found that only 16.4% of the programs studied had social media policies in place and that only 3.6% of graduate students were aware that they existed (Pham et al., 2014). This distance between policy presence and policy awareness is important to note and to explore further.

Awareness does not always equal understanding, though. Neill and Moody (2015) found that of 165 human resources professionals in the midwestern and southwestern United States, only 45% were "educated" concerning their respective company social media policies. The researchers advised that human resources professionals be knowledgeable in the areas in which they are enforcing policy, because their jobs "[include] making communications decisions that may lead to the success or failure of an enterprise" (p. 117).

Likewise, staff members tasked with university branding and reputation management must also be up to date on social media policies to best direct the institution's marketing efforts for the institution's success because social media presence can impact future funding, attendance figures, and advancement opportunities. Social media can be used to promote news, stories, events, and successes; in many cases, universities are increasing their presence on these channels to maintain a regular presence in the lives of students and other constituents.

Research suggests that an organization's size may have an impact on its adoption of a social media policy. El Ouirdi, et al. (2015) studied human resources professionals and social media policy adoption, confirming that larger organizations were more likely to have employee social media policies. Additionally, the researchers suggested that, based on such a vast array of organizational differences, a one-size-fits-all social media policy was not a reasonable goal, but

rather policies specifically tailored to meet an organization's unique needs would be best (El Ouirdi et al., 2015).

Development of Social Media Policies

The process of developing social media policies can vary greatly. Judge et al. (2010) called upon university leaders to model good behavior (a facet of which is inclusivity) in social media usage, and they suggested that doing so was even more important than creating social media policies. Junco (2011) suggested that when social media policies are being developed, they should be done so by a committee that is made up of diverse campus constituents ---students, staff, faculty, administrators, individuals with varying technology skills, etc. Additionally, the committee's work must be transparent, consider privacy issues, relate to the institution's educational mission, and be easily read, understood, and accessed (Junco, 2011). Opgenhaffen and Claeys (2017) also stressed the value of including all employees in the policy drafting process.

When drafting a social media policy, an institution must consider both on-campus and off-campus constituents, as well as those who may not be supportive of a new policy. Opgenhaffen and Claeys (2017) found that some employees did not want social media policies, because they may be "contrary to the freedom of expression and trust in the employee" (p. 138). In O'Connor et al.'s (2016) study on university students' knowledge, understanding, and opinions of social media policies, 69.8% of students did not know if the university had a social media policy, and only 23.9% of students believed that their university should be able to take disciplinary action against them based upon their social media posts. This information illustrates the case for creating an environment steeped in policy education first and enforcement second.

One way that universities could address social media and its potential pitfalls could be to simply ban it (or ignore it) outright – a simple, though ineffective, solution. Entities taking this

approach may miss opportunities and may even violate individual rights (Maxfield, 2011). If an institution's situation requires that social media be banned, Bon, et al., (2013) suggested using alternative tools with similar features, such as learning management systems with built-in chat or discussion features, that include greater privacy protection than social media might offer.

Bretschneider and Parker (2016) found that in some cases, formalizing social media policies may normalize social media use to the extent that employees feel more comfortable using it in their work and are not concerned about its appropriateness. If clear guidelines delineate what is not acceptable, then employees can easily identify the limitations and boundaries of their use. To ensure employees understand policies, Bon, et al. (2013) recommended regular professional development opportunities and annual acceptable usage agreements. Likewise, Schachter (2013) stressed the importance of prevention rather than punishment when creating and educating faculty and students about social media policies, also promoting the concept of annual updates and workshops.

Pham, et al. (2014) proposed an alternative to developing a stand-alone social media policy, suggesting that revising and refining current acceptable use or communications policies might be sufficient. This suggestion contrasts with Bon et al. (2013) and Schachter's (2013) advice that social media policies should be separate from other policies to be the most thorough. McCarthy (2015) and Bon et al. (2013) suggested that it may be useful to consider current campus policies, such as conduct policies, and integrate those into the social media policy. Reviewing and integrating existing policies, such as students' rights and responsibilities, IT and security policies, and communication policies, can add credibility (Pasquini, 2016).

Composition of Social Media Policies

Though social media policy composition appeared diverse at first-glace, a review of common components demonstrated agreement on inclusion of many elements. A discussion of these elements follows, with Table 1 listing the compiled elements in summary.

Researchers suggested that social media policies be written from an educational standpoint rather than as regulatory documents. Bon et al. (2013) stressed that the focus of social media policies should be to promote and guide appropriate and acceptable use to enhance educational activities. Simply setting policies is not enough; policymakers must ensure that students, faculty, and staff understand what the policies entail and how they apply to their everyday routines and responsibilities. Likewise, Pasquini (2016) suggested that administrators create social media policies that offer guidelines, following a coaching manner rather than a regulatory manner. El Ouirdi et al. (2015) also made this distinction, identifying clear differences between social media policies and social media guidelines. A social media policy must be regulatory, but not to the extent that it discourages creativity, innovation, or productivity on the job (or in the classroom) (Bretschneider & Parker, 2016; Schachter, 2013).

As with other policies, creating a means to report misuse is important. Pham et al. (2014) and Timm and Duven (2008) recommended that social media policies outline how to identify and report unacceptable online behavior. Similarly, Creque (2010) recommended the inclusion of information on the institution's right to remove, request removal of, or block inappropriate materials on pages affiliated with the institution. Eisler (2001) contributed items to include in higher education communications policies: acceptable and responsible use in content, ethics, fair use, privacy, common sense and netiquette, technology resources, access policies, disabilities, home access, and security. Pham et al. (2014) also suggested that ethical usage be addressed in campus social media policies, due to online behavior's potential to "negatively influence [an] individual's

professionalism and/or damage credibility" (p. 140.) Likewise, policy researchers at the Association of Records Managers and Administrators (2013) created a robust list of "required policy elements" for those institutions creating a social media policy, including definitions, expectations of privacy, intellectual property statements, and enforcement statements. Like the Association of Records Managers and Administrators (2013), Bon et al. (2013) suggested that social media policies define key terms, specify disciplinary consequences, and offer guidelines for appropriate usage. Schachter (2013) went one step further, suggesting avenues for appealing disciplinary actions. In summary, Table 1 lists the recommended social media policy components based on the literature. These elements will be used in the data analysis that follows.

Table 1

Compiled List of Recommended Social Media Policy Components

Components	Sources
Social media definitions	Association of Records Managers and Administrators (2013); Bon et al. (2013); Karpman & Drisko (2016)
Connections/relations to existing policies	Bon et al. (2013); Karpman & Drisko (2016); McCarthy (2015); Pasquini (2016)
Guidelines for appropriate usage	Association of Records Managers and Administrators (2013); Bon et al. (2013); El Ouirdi, et al. (2015); Karpman & Drisko (2016); Pasquini (2016)
Disciplinary actions to be taken	Pham et al. (2014); Karpman & Drisko (2016); Rooksby (2015); Schachter (2013); Creque (2010)
How to appeal disciplinary action	Schachter (2013)
How to report negative or damaging social media usage	Pham et al. (2014); Timm & Duven (2008)
Policy rationale	Association of Records Managers and Administrators (2013); Pham et al. (2014)
Reminder of the perpetuity of online posting	Pasquini (2016); Schachter (2013)
Caution against action representing the university in an official capacity	Karpman & Drisko (2016); Pasquini (2016)
Guidelines/"How to"	Karpman & Drisko (2016); Pasquini (2016)
Ethical Usage	Eisler (2001); Pham et al. (2014)

The theoretical constructs guiding this study are derived from current literature on policy development and social media usage.

(a) Universities should adopt social media policies that "balance the legitimate use of social media to enhance learning against the concerns of unprofessional or inappropriate use of various online technologies" (Bon et al., 2013, p. 196)

(b) Social media policies are important for the purposes of supporting campus usage that leads to positive outcomes and for mitigating and intervening in usage that leads to negative outcomes, thus providing benefit to the university campus (Junco, 2011).

(c) University policies must be continuously revisited and revised as contexts change, especially with regards to technological development (Bernard, 2010).

Research Questions

The research questions explored in this study focus on policy components recommended by the literature, as well as the intersection of theory and practice.

(a) How well are the components recommended by current literature on social media policies addressed within a sample of university social media policies?

(b) What similarities and differences exist among university social media policies among a sample of institutions?

(c) What components are utilized by university social media policies yet not addressed in the literature?

Methodology

We explored the research questions using a qualitative approach via document analysis. We evaluated a sample of social media policies (N=32) against the recommended social media policy components derived from existing literature (Table 1) to evaluate adherence to recommended best

practices, as well as to make comparisons across institutions and identify discrepancies that might illuminate future directions in policy creation. We used the Carnegie Classifications Custom Listings online tool to create a list of higher education institutions which met the following decision criteria: four-year and above institution, large-sized, primarily residential, very-high or high undergraduate attendance, public, and located in the southeastern United States. These decision criteria yielded 32 universities, which provided a suitable sample size.

Institutions of large-size and of four-year and above degree programs were chosen based upon El Ouirdi et al.'s (2015) finding that larger tend to be more likely to have adopted social media policies. Residential characteristics and institutions with high undergraduate populations were chosen to focus on universities that catered to traditional-aged students. Public institutions were chosen to avoid a sample with a very homogenous campus population (i.e., all subscribing to the same religious faith) that may not be representative of the general population.

Data Collection

Data collection involved Internet searches to locate institutional social media policies by using search terms, such as the institution's name and "social media policy" or "social media rules." We anticipated that not all 32 institutions would have social media policies available online. For 28 (87.5%) of the institutions, the social media policies were in the first 5 to 10 search results. For 4 (12.5%) of the institutions, further research was needed, such as visiting the institution's general policies page or online handbooks.

During this process, an unexpected dichotomy emerged. All 32 institutions had some form of social media document or section on their website. Differences arose in whether that document was (a) a set of rules related to using social media as a university constituent (a social media usage policy) or (b) a set of guidelines to help campus users utilize social media most effectively and

safely (social media guidelines). Twenty-five (78%) of the institutions posted (self-identified) social media *policies*; one of these social media policies was department-specific, rather than institution-wide. Twenty-one (66%) of the institutions posted (self-identified) social media *guidelines*. Fourteen (44%) of the institutions posted both items. These contrasts were consistent with El Ouirdi et al.'s (2015) discussion on the organization of institutional social media use as either *policies* or *guidelines*.

As data collection continued, it became apparent that policy developers at the universities may simply have chosen different terminology when labeling these documents. For example, 25 (78%) of the universities utilized the term *policy* to title their online documentation related to social media rules, guidelines, or regulations, while 21 (66%) universities utilized the term *guidelines* for the same function. Additionally, 14 (44%) institutions included both social media *policies* and social media *guidelines* as defined in the previous paragraph. To ensure that the sample included only the documents relevant to the current study, we first established the following definitions:

> ***Social media policy***: a set of rules and requirements related to using social media within or concerning an organization or a role within an organization.
>
> ***Social media guidelines:*** a set of standards to aid users in utilizing social media effectively and safely.

In accordance with these definitions, we revised the sample to include only policies that met the following additional decision rules:

- include only documents that are institution-wide
- include only documents that are stand-alone (not embedded within another policy)
- include only documents that directly mention social media (as opposed to ones that indirectly alluded to online communications channels or similar)

- include all social media related documents (not discriminating upon whether they were described as *policies* or *guidelines*)

Two institutions from the same state posted the document on their website, so we only included it once in the revised sample, which ultimately included 20 policies from 11 states.

Data Analysis & Results

Data were analyzed in a three-stage approach, using QSR International's NVivo 11 Pro software. First, deductive coding for each document was performed using the eleven components identified in Table 1. After all the documents were coded for these components, a repeat round of coding was performed to ensure no items were overlooked in the first round. During this second round of coding, both visual searches and word searches using NVivo's *Find* tool were conducted.

Next, inductive coding for each document was performed with the intention of developing new codes to describe components not included in Table 1. This process yielded twenty-one initial codes. A repeat round of coding was performed on all documents using this list of twenty-one new codes. During this round of coding, both visual searches and word searches using NVivo's *Find* tool were conducted. Last, the inductive and deductive codes were consolidated into categories for organizational purposes. Four main topic areas were generated, and codes were classified according to topics under which they best fit, as illustrated in Table 2. A discussion of each of the topic areas follows.

Table 2

Inductive and Deductive Codes Categorized According to Topic Area

Topic Area	Codes & Frequencies
Policy focus and overview	connections to other campus policies (18), policy rationale (17), target audience of policy (17), definition of social media (13), policy is subject to change (5)
University image	branding (19), acting as a university representative

	(17), links to university (10), crisis information dissemination (9), contact with news media (7)
Account creation and maintenance	identify account administrator (16), register account on campus (14), utilize campus resources if help is needed (13), disciplinary actions (consequences, appeals, reporting) (12), adhere to specific social media site rules (8), create a social media plan (7), suggestions for classroom use (4)
Posting on social media	content: accuracy (14), grammar/mechanics (6), photography (10) best practices: adverting/promotion (14), ethical usage (16), timeliness (11) interactions with others: target audience (12), opposing views (9), interaction with students (2)

Discussion of the Results

The results of the data analysis illuminated the relationship between the literature on social media policy development and actual composition of social media policies. Overall, significant overlap existed, but the policies added valuable detail to the components suggested by the literature. Additionally, the sample of university social media policies converged upon common components, which in combination with the components suggested by the literature, contributed to the creation of an expanded list of social media policy components in Table 3. Discussion of each of the four topic areas in this list and their components follows.

Table 3
Resulting List of University Social Media Policy Components

Policy Focus and Overview
Policy Rationale
Target audience of the policy
Policy's connection to existing university policies (and which ones)
Policy subjectivity to change
Institution's definition of social media
University Image
Guidance for acting as university representative
Branding guidelines and best practices
Guidance for contact with news media (initiated and uninitiated)

Crisis information dissemination
Links to relevant university webpages

Account Creation and Maintenance
Identifying account administrator
Registering account on campus
Creating a social media plan
Adhering to specific social media site rules
Inclusion of disciplinary action (and appeal process)
Suggestions for classroom use
Utilization and availability of campus resources (help/reporting misuse)

Posting (content, best practices, and interactions with others)
Accuracy of information
Utilization of proper grammar/mechanics
Integration of photography (permissions, credits)
Cautions regarding advertising/promotion
Ethical usage
Timeliness and frequency of posts
Target audience of the posts
Addressing opposing views
Guiding interactions with students

Policy Focus and Overview

Connection to other policies.

Ninety percent of the policies linked to or mentioned existing policies, such as FERPA (Family Educational Rights and Privacy Act of 1974) policies, IT policies, and acceptable use policies, strengthening the suggestions by previous researchers that social media policies should be connected to and should incorporate existing campus policies (McCarthy, 2015; Pasquini, 2016; Bon et al., 2013). Additionally, 25% of the policies stated that they are subject to be changed as needed according to advancements and university needs. Adapting existing policies for changing needs was an important consideration that Eisler (2001) promoted for developing technology-related policies.

Policy rationale.

Most policies (85%) included a rationale or introduction, stating their purpose or background. While these rationales varied in wording, they were generally focused on the topics of the increasing popularity of social media usage, the use of social media policies to meet university goals, and the potential pitfalls of social media usage.

Target audience of policy.

Again, 85% of the policies mentioned their target audience (i.e., students, faculty, staff). Of those policies, 100% targeted university staff, 94% targeted faculty, and 41% targeted students. It is important to note that though 94% of the policies stated that they were developed with faculty members in mind, only 20% of all policies mentioned classroom social media usage.

Definitions.

Sixty-five percent of the policies defined social media with several definitions including specific channels (i.e., Facebook, Twitter). Prefacing the university social media policy with a definition of what social media is and even adding examples was a policy component that Karpman and Drisko (2016) identified as a good practice.

University Image

Most of the directly mentioned university image. Adhering to a consistent branding campaign, including but not limited to logo usage, color scheme, naming and abbreviation mechanism, and university mission, is important to developing and maintaining university image. Ninety-five percent of the policies included components related to appropriate branding, including logo usage, proper naming conventions of social media accounts, and references to the university's official branding standards and policies.

Eighty-five percent of the policies suggested that social media account administrators exercise caution in messaging, as they could be interpreted as official university representatives.

Policies used two avenues of addressing this issue: (a) reminding users to exercise caution and use professionalism, and (b) cautioning social media users to explicitly state that they represent their own views (not those of the university). Similarly, dissemination of university-related news was included in half of the policies, requiring links to the university's website to be used. Thirty-five percent suggested providing links to any external sources discussed in posts, with the goal of increasing credibility.

Also related to news dissemination, 45% of the policies included directives for disseminating crisis information. This guidance was generally uniform, including (a) not posting unapproved information to social media accounts, (b) not including personal opinions on social media accounts related to the situation, and (c) acting to ensure a unified message is distributed across all channels. Thirty-five percent of the policies specifically addressed what to do if contacted by the news media. This guidance related to both outreach to news media entities and response to news media outreach, as illustrated, respectively, in the following policy sections.

> All traditional news media outreach on behalf of the university or its departments or operating units should be initiated by or coordinated through the Office of Public Affairs. All news media outreach shall be consistent with the university's strategic priorities and messages.
>
> If a member of the media or press contacts faculty or staff about posts made in online forums that relate to [Institution] in any way, faculty/staff must alert their manager/leadership and contact the Division of Marketing & Communications before responding at ###-###-####.

Account Creation and Maintenance

All twenty social media policies in the sample included components related to appropriate social media account creation. These components generally presented an instructive approach but held value to even a skilled social media user.

When creating social media accounts, 80% of the samples policies called for identifying dedicated account administrator(s) to control image and message, 70% of the sample policies required university-related social media accounts to be registered (and monitored) via an office on campus., and 35% of the sample policies suggested creating an official social media plan, like a business start-up plan. While seemingly intuitive, 40% of the policies directed users to adhere to the channel's site rules.

Sixty-five percent of the policies included resources for seeking help, such as the phone number or email address for the Office of Public Affairs. Additionally, 25% of the policies referenced a dedicated social media team or specialist who could offer assistance, and one policy mentioned on-campus social media training, which supports Bon et al. (2013) and Schachter's (2013) recommendations concerning learning and professional development opportunities.

While most of the policies were generic in nature, 20% referenced classroom usage of social media (i.e., within a course, directed by a faculty member). One of the policies directly suggested that social media be incorporated into the classroom: "faculty should consider social media sites as a supplemental resource for course or work-related communication," while another cautioned faculty that they "may not require a student to post or interact with a social networking site as part of an academic assignment." More research is needed on social media policies related specifically to faculty. Classroom-specific policies may be most appropriate.

Eighty percent of the policies addressed disciplinary action and response, but they did not do so in a uniform manner. Fifty percent stated directly that the university and/or administrators had the

right to remove or request removal of content not meeting official standards (i.e., inappropriate, incorrect, offensive, etc.), and 30% of the policies highlighted university-affiliated social media account administrators' responsibility to address (rather than ignore) issues that arise. Twenty percent of the policies mentioned potential suspension or termination, 15% mentioned revoking campus computer or posting privileges, and 20% mentioned holding disciplinary proceedings. These consequences for inappropriate use aligned with Schachter's (2013) recommendations on prevention of misuse and can also assist users with identifying and reporting unacceptable behavior (Pham et al., 2014; Timm & Duven, 2008).

Posting on Social Media

Components related to posting made up most of the sample policies. Each policy included at least some amount of guidance and directives to aid university-affiliated social media account managers in posting management.

Content.

Social media accounts are commonly used as official communication channels. As such, account administrators need to be mindful of accuracy, grammar and mechanics, and photography rights and ownership when composing their posts. Accuracy was a topic covered in 70% of the policies with guidance regarding fact-checking, keeping information up to date, including links to original articles or posts, and taking ample time to compose posts correctly. Additionally, 20% of the policies addressed retracting inaccurate information.

As representatives of a university, using proper grammar and sentence mechanics is expected. Thirty percent of the policies addressed using appropriate grammar, spelling, and word choice. While one of the policies cautioned against using "inappropriate slang," another suggested avoiding posts composed of "overly technical or bureaucratic sounding language." This divergent

wording may not necessarily signify disagreement but rather the importance of avoiding extreme ends of word choice – too informal or too formal.

Last, half of the policies addressed the issue of photography and the rights of subjects and ownership. Privacy concerns were addressed regarding posting photos, including gaining written or verbal permission and violating the rights of minors. To circumvent the issue of obtaining permission to post photographs on social media accounts, one of the sample social media policies suggested that account administrators contact the university's public relations department to solicit approved photographs.

Best practices.

While best practices may vary, three main elements were commonly cited in the social media policies in the sample. Fifty-five percent of the policies recommended sustained activity and keeping account information up to date. While a few policies included suggestions on posting frequency (i.e., every day or weekly), others did not provide a precise number of postings but rather suggested "establish[ing] a regular cadence" or "post[ing] content regularly."

Likewise, account administrators must be careful not to advertise or promote organizations or individuals not affiliated with the university to avoid creating a conflict of interest. Seventy percent of the policies advised against this practice, making statements such as, "don't use the university to promote or endorse any product, cause or political party or candidate," "[do not] use resources or accounts for personal financial gain," and "do not make endorsements using the [university] logos or trademarks."

Ethical considerations were also a common topic in the policies, with 80% addressing ethics-related topics. Following FERPA laws regarding student privacy was especially common among the policies; it was included in 70% of the policies. Likewise, ensuring confidentiality was mentioned

in 55% of the policies. Likewise, providing links to sources of information was mentioned in 55% of the policies.

Interactions with others.

Social media accounts intrinsically allow for sharing of ideas, comments and feedback, and outreach; therefore, it is important that social media policies include guidelines for interacting with others. Forty percent of the policies reminded users that anything posted online can retain a semi-permanency, especially if seen, shared, or saved by others.

Tailoring posts to meet the needs of the target audience is also important, and 60% of the policies mentioned this. Policies included phrasing, such as "keep target audience in mind when posting," but a few of the policies were more specific in their wording.

> Post information about topics like [university] events or news only when you are sure it will be of interest to readers.
>
> All comments, links, photos, videos, etc. posted to the unit account must be on topic and relevant to the office and its audience.

One university's policy even reminded social media account administrators that "fans come from every background imaginable, and are from varied races, religions, cultures, and interests" and that anticipating perceptions by diverse groups is very important.

Conclusion

This qualitative study, guided by empirical document analysis, provides a foundational list of components from which to build personalized, university-specific social media policies for internal constituents in appropriate and effective use of this engaging and popular tool.

The social media policy components derived from the literature (Table 1) provided a broad view of categories for inclusion in university policies, while a review of existing university policies

enhanced those recommendation by illuminating specific elements for these categories. Expansion of this list (Table 3) added elements in each of the four topic areas (policy focus and overview, university image, account creation and maintenance, and posting).

In policy focus and overview topic area, we added target audience and the policy's subjectivity to change to the literature-derived elements of rationale, links to existing policies, and social media definition. We added information on branding, contact with news media, crisis information dissemination, and a directive to link to university official news and other webpages and announcements to the larger category of university image. We also expanded the category of account creation and maintenance with four new elements. In this topic area, we combined disciplinary action and appeal into one element, and housed guidelines for using social media and reporting misuse under an element related to campus resources availability.

Finally, the fourth topic area of posting included the greatest expansion from the literature with additional elements related to content (accuracy, grammar/mechanics, and photography), best practices (advertising/promotion and timeliness), and interactions with others (target audience, addressing opposing views, and interactions with students). The specificity of these items provides important clarity.

Overall, the components recommended by the current are addressed by the social media policies in the sample, but the sample policies provided important detail and explanation in each category. As these details were important in guiding content creation, we derived the list of recommended components for university social media policies in Table 3. This list serves as a starting-point for policy development for both university-wide policies and for constituent-specific policies. Future researchers are encouraged to add elements that may have been unintentionally omitted or that may become salient as these communications channels develop.

Areas for Future Research

This study provides the social media policy developer with a list of policy components based upon both theory and practice. While practice does not always reflect theory, this list provides a starting point from which to develop or revise a university social media policy. Areas for future research may be policy composition for specific constituents, such as students or faculty, as these policies may have different goals and thus may be structured differently. Additionally, research with a focus on policy differences based on institutional size and location (possibly exploring policies outside of the United States) may be illuminating. Finally, a timely area of potential research could involve policy creation and revision in response to current-day events.

Limitations

This study is limited based on its sample constraints and sample size. The results may differ with a more nationally representative sample of social media policies. Though saturation appeared to have been reached in the results, a larger sample may have provided more insight into policy composition across the United States.

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