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INFORMATION SYSTEMS EDUCATION JOURNAL

Editors

Challenges and Practices of Knowledge Sharing in E-learning: A Systematic Literature Review

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Abstract

E-learning has become an emerging approach to delivering knowledge and information to students. It presents significant challenges to sharing and understanding learners' knowledge, inquiries, interest, and needs. Educational organizations are expected to apply the appropriate practice to address knowledge-sharing challenges in the e-learning environment. In this study, through a systematic literature review, we intend to identify and synthesize knowledge-sharing challenges and practices as well as classify the most discussed challenges and practices in various contextual settings. The findings classify the knowledge-sharing challenges and practices in e-learning from four perspectives: organization, individual, knowledge and technology. This study aims to build a knowledge base to support future research and effective knowledge-sharing practices in the e-learning environment.

Keywords: e-learning, knowledge sharing, challenges, practices, online learning, literature review.

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Challenges and Practices of Knowledge Sharing in E-learning: A Systematic Literature Review

Gary Yu Zhao, Cindy Zhiling Tu and Joni Adkins

1. INTRODUCTION

E-learning (or online education, or virtual learning) has become a popular practice in many institutions. Generally, e-learning refers to the use of information and communication technology (ICT) (e.g., learning management systems, email, instant messaging, forums, blogs, social media, video conferencing tools, etc.) for knowledge delivery and learning (Levinsen, 2007). With e-learning, institutions can reduce education costs by increasing the student-to-teacher ratio without downgrading the learning quality, reduce physical plant costs, and reduce transportation costs (Wang & Chien, 2019). Also, in an e-learning context, learners and instructors can work together asynchronously regardless of time and place, synchronously with coordinated sessions, or a combination. The learner has more flexibility to arrange their learning practices at their own pace. Evidence shows that e-learning has positively affected the number of students pursuing higher education (Ferran et al., 2019). E-learning taking advantage of IT is beneficial to education, corporations and all types of learners (Wang & Chien, 2019). However, e-learning has come with many challenges, such as interaction, communication, coordination, and collaboration (Ferran et al., 2019; Leem & Lim, 2007). One of the key areas is knowledge sharing in an e-learning environment, as e-learning itself is a knowledge-intensive activity whose success heavily relies upon effective and efficient knowledge sharing among the subjects (Deng et al., 2019). Educators and learners may find it difficult to share both tacit and explicit knowledge within the e-learning context.

Knowledge sharing is an integral process of knowledge management (KM) through which explicit or tacit knowledge is communicated to other individuals (Becerra-Fernandez & Sabherwal, 2014). The goal of e-learning, to facilitate learning and to share knowledge, echoes the essence of KM. The advantages of e-learning, flexibility, personalization, and low cost enable an organization to enhance the practices of knowledge sharing. Simultaneously, knowledge sharing is the key to success for e-learning processes (Al-Emran & Teo, 2020; Yilmaz, 2016). Given the importance of knowledge sharing in e-learning, researchers and practitioners have been dedicating large amounts of work to help understand knowledge sharing challenges and devise appropriate practices to address the challenges. A meta-review on knowledge management and knowledge sharing reveals that there are barriers to knowledge sharing and good practices can be applied to conquer those obstacles in organizations (Asrar-ul-Haq & Anwar, 2016). It is also found that contextual factors affect the motivation of knowledge sharing (Rusu & Avasilcai, 2014). In this literature review, we aim to understand knowledge sharing challenges and practices reported by empirical studies in e-learning and demonstrate the contextual settings from which the challenges and practices are reported. We thus propose three research questions: (1) What are the knowledge-sharing challenges in e-learning? (2) What are the knowledge-sharing practices in e-learning? (3) In what contextual settings are challenges and practices reported?

Our systematic literature review (SLR) on knowledge sharing challenges and practices in e-learning aims at contributing to a growing knowledge body of knowledge sharing. This SLR is expected to inform the research community about popularly reported challenges and solutions to support knowledge sharing in e-learning.

2. ARTICLE SEARCH PROCESS

We formulated the search string based on three compartments to locate relevant literature. The search string is ("e-learning" OR "online learning" OR "online education" OR "virtual classroom" OR "virtual learning" OR "virtual education" OR "remote learning" OR "remote education" OR "distance education") AND ("knowledge sharing" OR "knowledge transfer" OR "knowledge shift" OR "knowledge exchange" OR "knowledge distribution" OR "knowledge transfer process" OR "knowledge flow" OR "knowledge management" OR "knowledge integration") AND ("challenge*" OR "problem*" OR "barrier*" OR "obstacle*" OR "risk*" OR "best practices" OR "strategy*" OR "approach*" OR "solution*" OR "mechanism*" OR "assessment*" OR "Evaluation*" OR "practice*"

OR "mitigate*"). We used Google Scholar to test all the segments and combinations of the searching string. After this testing, we conducted title/keyword/abstract searches from four prominent online databases: ABI/INFORM Collection, Education Database (ProQuest), ScienceDirect (Elsevier), and ACM Digital Library.

For each database search, the criteria used for including/excluding papers are as follows:

- Peer-reviewed papers only – exclude wire feeds.
- Full text only.
- Limit the source type to: scholarly journals, conference papers & proceedings, dissertations & theses.
- Limit the document type to: article, conference paper, conference proceeding, dissertation/thesis, literature review, report, review.
- Limit the subject area to: "Computer Science", "Business, Management and Accounting", "Decision Sciences", "Economics, Econometrics and Finance".
- Limit language to: English.
- Limit the oldest publication date to: January 1, 2007

We manually scanned abstracts and parts of introductions and filtered out those less relevant articles focusing on government management, technology features, technology implementation, industry usage, etc. Moreover, we employed snowballing technique to enroll a few essential papers. Finally, 39 peer-reviewed academic articles were selected for the literature review.

3. DATA ANALYSIS

To answer the research questions, we identified the relevant information and extracted it from each paper. For synthesizing the extracted data, we divided the data into (i) demographic and contextual attributes and (ii) knowledge sharing challenges and practices. The first data set was analyzed through statistical techniques and produced descriptive results. The second set of data items was analyzed with a thematic analysis method.

Demographic Attributes

Figure 1 shows the number of selected papers published per year within the review period from 2007 to 2021. Overall, the number of published studies on knowledge sharing in e-learning has increased since 2015. 28 papers out of 40 (70%) were published in the last seven years, which shows the phenomenon of knowledge sharing in e-learning is receiving increasing interest and attention from researchers and practitioners.

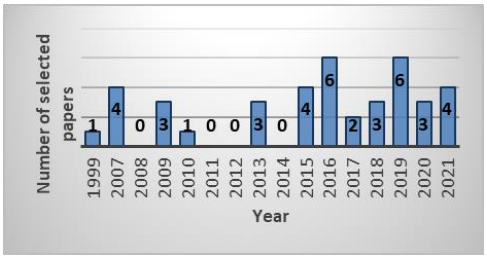

Figure 1: Papers Published by Year

Country	Paper Count	Country	Paper Count
United States	8	Brunei	1
Malaysia	4	Australia	1
Taiwan	3	Indonesia	1
China	3	Spain	1
India	3	UK	1
Turkey	2	Vietnam	1
Netherland	1	Czech	1
Denmark	1	Russia	1
Korea	1	Norway	1
Germany	1	Senegal	1
Mexico	1	Peru	1

Table 1: Locations of the e-Learning in Selected Studies

Table 1 shows that the reviewed studies were conducted in 22 different countries to address the knowledge-sharing issues and practices in the e-learning context. The most frequently involved country is the United States (8 papers), followed by Malaysia (4 papers), Taiwan, China, India (3 for each), Turkey (2 papers). Sixteen studies are from other 16 countries for each.

Technologies Used for Knowledge Sharing in e-Learning	Paper Count
Learning Management System (LMS), e.g., Moodle, Blackboard	12
Social network/social media, e.g., Facebook, Twitter	8
Synchronous conference system, e.g., Zoom, MS Teams	5
Blog and Forum, e.g., Blogger, Stack Exchange Forum	5
Semantic Web	5
Big data, data mining	4
Cloud computing	3
Artificial Intelligence (AI)	2
Others, e.g., expert system, intranet	3
Unclear	6

Table 2: Technologies Used for Knowledge Sharing in e-Learning

Information and communication technology (ICT) can facilitate knowledge sharing by reducing both time and spatial constraints among knowledge workers, thus enhancing their access to information related to knowledge (Hendriks, 1999). The success of knowledge sharing in e-learning relies on ICT such as Intranet, LMS platforms, social media, conference software, and so on. Therefore, we examined the applications and tools that had been reported in the reviewed papers (Table 2).

Research Methodology Attributes

We identified the research methods employed in the reviewed papers based on what was stated in the paper, e.g., we classified the paper under the case study category if the authors claimed that they had used a case study research method.

Figure 2: Distribution of Research Methods Employed in Selected Studies

Figure 2 shows the percentage of different types of research methods used in all selected studies. The case study (36%) and empirical survey (29%) are two main-stream research methods in the research of knowledge sharing in the e-learning context. Four papers were based on design science, which was focused on demonstrating how to design new applications to help knowledge sharing in e-learning processes. Four studies used the experiment study method to examine the processes related to knowledge sharing by using a specific technology in online learning. Four papers conducted a literature review to examine the factors that affected the adoption and usage of a particular technology used for knowledge sharing in online learning and proposed their own research models. There were two field studies (5%) and one action research (2%). Furthermore, we found that two papers used more than one research method, i.e., design science combined with survey and design science with experiment study.

Figure 3 shows that interview (41%) was the primary data collection method, followed by secondary data (23%), observation (18%), questionnaire (13%), and lab experiment (5%). Also, we noticed that some papers used more than one data collection method. For example, Rani et al. (2015) combined observation and questionnaire to get the data of using a newly designed application; Anshari et al. (2016) blended secondary data and interviews to obtain the results of the usage of big data and social networks.

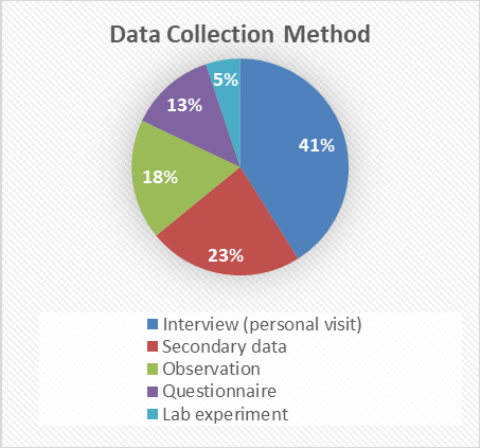

Figure 3: Distribution of Data Collection Methods in Selected Studies

Figure 4 presents that the most used data analysis approach was qualitative analysis (22 papers, 57%), followed by 28% of papers using quantitative analysis. Only six papers used both qualitative and quantitative analysis approaches.

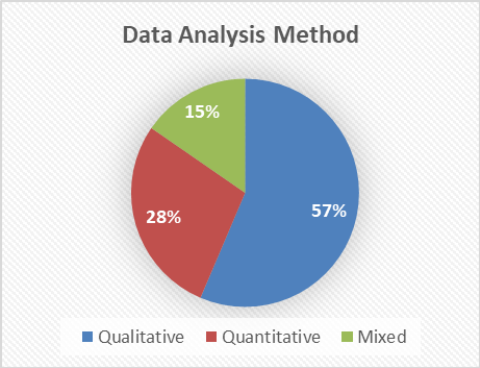

Figure 4: Distribution of Data Analysis Method in Selected Studies

Research Contextual Settings

The reviewed papers were sorted into education and industry cases. The education category refers to those studies conducted in educational settings (universities, colleges, high schools, etc.). The industry category includes the studies performed in business organizations. To gain a better understanding of knowledge sharing in the education context, we classified the studies into two sub-categories, which were 100% online e-learning and blended online e-learning.

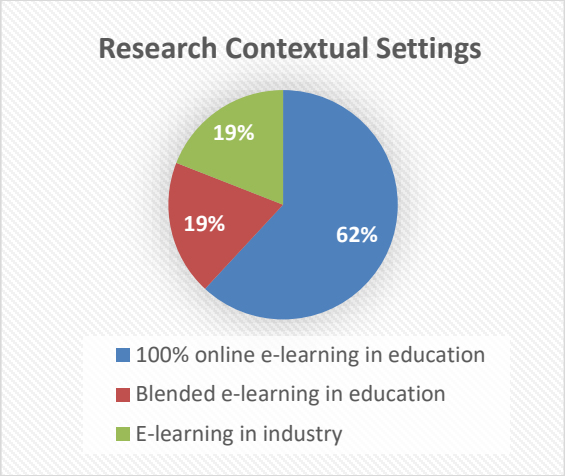

Figure 5: Distribution of Contextual Settings in Selected Studies

Figure 5 displays that most of the studies (81%) are education cases, with only eight papers (19%) in industry research. On the other hand, in the education settings, 62% of all selected studies are carried out in 100% online e-learning context, and 19% report blended online e-learning cases.

Knowledge Sharing Challenges in e-Learning

To answer the first research question, "What are the key challenges of sharing knowledge in e-learning?", we adopted the thematic analysis method to analyze this data from all reviewed papers. We present all challenges from four perspectives: (1) Organizational perspective: challenges are correlated with organizations' management and actions towards knowledge sharing in e-learning; (2) Individual perspective: challenges are related to an individual's intention to share knowledge and individual's abilities and skills for sharing knowledge; (3) Knowledge perspective: challenges are from knowledge itself; (4) Technology perspective: challenges are associated with IT technological issues. Table 3 shows the knowledge-sharing challenges in e-learning reported in the selected studies.

Knowledge sharing practices in e-learning

This section answers the second research question, "What are the key practices of sharing knowledge in e-learning?" Table 4 shows the knowledge-sharing practices in e-learning reported in the selected studies. Following the challenge section, we present the practices from the same four perspectives.

	Challenge	Key Points
Organization Perspective	1. Institutional Policies for Knowledge Sharing (KS)	* Knowledge management and communication policy (Damsa et al., 2021; Deng et al., 2019; Hendriks, 1999; Montoya, 2013; Pokrovskaia et al., 2021)
		* Open Access Policy (Damsa et al., 2021; Montoya, 2013)
		* Rewards for KS (Damsa et al., 2021; Ferran et al., 2019; Leem & Lim, 2007; Liou et al., 2016)
	2. Community Culture for KS	* Cultures of Collaboration and online activity (Damsa et al., 2021; Ferran et al., 2019; Hew & Kadir, 2017; Kunthi et al., 2018; Leem & Lim, 2007; Sadiq Sohail & Daud, 2009; Wu & Zhang, 2015; Zanjani et al., 2016)
		* Community Identification, e.g., reputation in the community (Hew & Hara, 2007; Liou et al., 2016)
	3. Human Resource Support	* Evaluation System of Instructor's and Student's Performance (Dvořáková & Kulachinskaya, 2020; Leem & Lim, 2007)
		* Staff work-life balance (Dvořáková & Kulachinskaya, 2020; Ferran et al., 2019)
		* Online teacher's qualification impact knowledge sharing (Leem & Lim, 2007; Levinsen, 2007)
	4. Budget and Cost	* Limited budget for human resource and technology (Ferran et al., 2019; Leem & Lim, 2007)

Individual Perspective	5. Teacher's Competence and Skills	* Teaching methods and teaching style for KS (Dvořáková & Kulachinskaya, 2020; Levinsen, 2007; Zach & Agosto, 2009; Zanjani et al., 2016)
		* Teacher's digital capability (Altınay et al., 2019; Levinsen, 2007; Zach & Agosto, 2009)
		* Teacher's communication skills (Altınay et al., 2019; Levinsen, 2007; Zach & Agosto, 2009)
	6. Student's Competence and Skills	* Online learning skills, critical think skills (Hew & Kadir, 2017; Zach & Agosto, 2009)
		* Technology skills (Damsa et al., 2021; Hew & Hara, 2007; Zach & Agosto, 2009)
		* Communication skills and teamwork skills (Hew & Kadir, 2017; Zach & Agosto, 2009)
	7. Individual's Intention to Share Knowledge	* Knowledge sharing self-efficacy (Kunthi et al., 2018; Liou et al., 2016)
		* The anticipated reciprocal relationship, norm of reciprocity (Hendriks, 1999; Liou et al., 2016)
		* Perceived trust (Hew & Kadir, 2017; Kunthi et al., 2018; Yang et al., 2007)
		* Perceived usefulness (Al-Emran & Teo, 2020; Kunthi et al., 2018)
		* Knowledge power (Hew & Hara, 2007; Kunthi et al., 2018)
		* Competing priority (Hew & Hara, 2007)
		* Attitudes to knowledge sharing (Hew & Hara, 2007; Sadiq Sohail & Daud, 2009; Zach & Agosto, 2009)
Knowledge Perspective	8. Quality knowledge acquirement	* Difficulty in finding quality knowledge (Hendriks, 1999; Sabitha et al., 2017; Yang et al., 2007)
		* Lack of knowledge to share (Ferran et al., 2019; Hew & Hara, 2007)
		* Learning outcomes (Kunthi et al., 2018)
		* Nature of knowledge (Sadiq Sohail & Daud, 2009)
	9. Counter-knowledge	* Circulation of unverified information (Cegarra-Sánchez et al., 2018)
Technology Perspective	10. IT infrastructure support	* The quality of Internet connection (Dvořáková & Kulachinskaya, 2020; Ferran et al., 2019)
		* Cloud-based platform (Ferran et al., 2019; Zach & Agosto, 2009)
	11. Limitation of technologies for KS	* Need of collaborate tools (Ferran et al., 2019; Zach & Agosto, 2009)
		* Incompatibility of new technology (Zach & Agosto, 2009)
		* Technology learning curve (Agosto et al., 2013; Zach & Agosto, 2009)
	12. Defects of LMS platform	* Not running in real-time (Cheng, 2013)
		* Confidentiality consideration (Hew & Hara, 2007)
		* Content-focused than learner-focused (Cheng, 2013; Li, 2018; Sabitha et al., 2017)

Table 3: Knowledge Sharing Challenges in E-learning

	Practice	Key Points
Organization Perspective	1. Establish the KS virtual community	* Create basic rule and regulation for KS (Deng et al., 2019; Pokrovskaia et al., 2021)
		* Build the collaborative organization culture (Deng et al., 2019; Leem & Lim, 2007; Wu & Zhang, 2015)
		* Innovative models with open access systems (Montoya, 2013)
	2. Human Resource Support	* Facilitate all kinds of training (Montoya, 2013)
		* Acquire the tenant (Leem & Lim, 2007; Levinsen, 2007; Wu & Zhang, 2015)
	3. Increase the budget for KS	* Technology investment (Ferran et al., 2019; Leem & Lim, 2007)
		* Human resource investment (Leem & Lim, 2007)
Individual Perspective	4. Incentives and Motivations	* Reward for faculty to encourage KS (Leem & Lim, 2007; Sadiq Sohail & Daud, 2009)
		* Rating for individuals' knowledge sharing (Hew & Hara, 2007; Leem & Lim, 2007; Wu & Zhang, 2015)
		* Select the best-matched partners (Wu & Zhang, 2015)
	5. Competency development	* Pedagogical methods training (Dvořáková & Kulachinskaya, 2020; Levinsen, 2007; Zach & Agosto, 2009; Zanjani et al., 2016)
		* Technology and tools training (Altınay et al., 2019; Levinsen, 2007)
		* Online communication skills practice (Altınay et al., 2019; Levinsen, 2007; Zach & Agosto, 2009)
	6. Social trust relationship	* Knowledge sharing on the personal network (Hew & Kadir, 2017; Kunthi et al., 2018; Yang et al., 2007)
		* Build trust through offline activities (Hew & Kadir, 2017; Wu & Zhang, 2015)
Knowledge perspective	7. Acquire quality knowledge	* Knowledge quality assurance system (Hendriks, 1999; Leem & Lim, 2007; Sadiq Sohail & Daud, 2009; Yang et al., 2007)
		* Redefine the knowledge domain (Sadiq Sohail & Daud, 2009; Wu & Zhang, 2015)
		* Create collective knowledge at the inter-organization level (Wu & Zhang, 2015)
		* Increase awareness of the other agents' knowledge (Wu & Zhang, 2015)
Technology Perspective	8. Improve IT infrastructure	* Mobilization through innovation networks (Montoya, 2013)
		* Application of cloud-computing (Anshari et al., 2016; Ferran et al., 2019; Zach & Agosto, 2009)
	9. Implement novel technologies for KS	* Social media platform facilitating KS (Agosto et al., 2013; Cheng, 2013; Kara et al., 2020; Mbacké et al., 2021; Yang et al., 2007; Zhang et al., 2015)
		* Forum, ePortfolio, and e-newsletter applications (Ahmed et al., 2015; Wang & Chien, 2019; Zhang et al., 2009)
		* Semantic Web (Web 3.0) (Anshari et al., 2016; Rani et al., 2015; Welter et al., 2010)
		* AI technology (Maity, 2019; Sabitha et al., 2016)
		* Data mining and data analytics (Anshari et al., 2016; Marchena Sekli & De la Vega, 2021; Sabitha et al., 2017; Uhomoibhi et al., 2019)

Table 4: Knowledge Sharing Practices in E-learning

4. DISCUSSION AND FINDINGS

Based on the data retrieved from reviewed papers, we have classified challenges and practices into four categories from different perspectives: organization perspective, individual perspective, knowledge perspective, and technology perspective.

Perspective	Challenges	Practices	Total
Organization	16	8	24
Individual	15	15	30
Knowledge	8	5	13
Technology	8	20	28

Table 5: Distribution of Papers on KS Challenges and Practices

Table 5 shows the distribution of selected studies on knowledge sharing challenges and practices. This result accordingly demonstrates that the primary challenges and practices of knowledge sharing in e-learning are from individual, organization, and technology perspectives. Another interesting finding is that only 8 papers report technology challenges, but 20 papers report technology practices. We may posit that the e-learning community has more choices and more new technologies emerge to address the challenges from the technical aspect.

Table 6 shows the most frequently presented challenges and practices in the reviewed studies. Among all the reported challenges explained in the previous section, community culture for knowledge sharing, individual's intention to share knowledge, and organization's policy for knowledge sharing has been proposed more frequent than any others, followed by teacher's competence and skills for knowledge sharing and the acquirement of quality knowledge. Technology challenges are not in the top 5. It also shows the top 5 reported knowledge sharing practices in the e-learning environment. Eighteen studies present the practice of implementing novel techniques for advancing knowledge sharing. At the organization level, five papers reported establishing the knowledge-sharing virtual community, and four papers proposed the practice of support from human resources. At the individual level, five papers reported developing individual competency, and four reported the practice related to incentives and motivations for instructors and learners. The practices associated with knowledge itself are not in the top 5.

From the list of most popular practices, our review shows that ICT is one of the most important key factors that affect knowledge sharing activities. Researchers believe that the leverage of emergent technologies can address most challenges in the e-learning community. Our review also reveals that the challenge of counter-knowledge (knowledge that was correct at one time but has changed) has not been paid enough attention in both academic areas and industry, which means that this topic may attract more researchers and practitioners in the future.

	Factors	**Paper Count**
Challenges	Community culture for knowledge sharing	10
	Individual's intention to share knowledge	9
	Organizational policies for knowledge sharing	8
	Teacher's competence and skills for knowledge sharing	7
	Quality knowledge acquirement	7
Practices	Implement novel techniques for knowledge sharing	18
	Establish the knowledge sharing virtual community	5
	Individual's competency development	5
	Human resource support	4
	Incentives and motivations for individuals	4

Table 6: Top 5 Challenges and Practices Most Frequently Reported

Technologies provide individual learners and instructors with the tools to support and improve their knowledge-sharing capabilities and skills. Our review discovered that many researchers proposed different emergent technologies to address knowledge sharing in the e-learning context. A LMS e-learning platform is the most frequently reported technology practice for facilitating knowledge sharing, followed by social media, big data analytics, and semantic web techniques. In these empirical studies, most researchers examined the factors that affect the adoption of the technologies for knowledge sharing, designed and verified the validity of the new knowledge-sharing systems, and demonstrated how the technologies support knowledge sharing. However, in all reviewed studies, we have not found any paper that

conducted a comparison study on the different supports for knowledge sharing between technological practices and non-technological practices. Moreover, there was little work on how a specific technical practice incorporating non-technological practices facilitates knowledge sharing. In addition, there is a lack of research on how the various technologies support knowledge sharing in 100% online e-learning, blended e-learning, and industry e-learning contextual settings.

5. LIMITATIONS

This paper only addressed research found in four databases. These were selected due to their availability and relation to computer science and information systems. There would be more articles to examine if the search terms were to be used in other databases so the findings could change with additional databases. Also, there could be other search terms and combinations that could be used to find similar articles.

6. CONCLUSIONS

Naturally, e-learning involves highly intellectual activities that share knowledge between instructors and learners and among learners (Altınay et al., 2019). Sharing knowledge is essential for successfully delivering and gaining knowledge in the e-learning process. Future studies could examine the literature to see if there are differences between 100% online and hybrid e-learning as it related to knowledge sharing. This literature review is potentially beneficial to both e-learning and knowledge management fields. On the one hand, this review provides information to understand the challenges in the e-learning process from the knowledge sharing perspective. On the other hand, this research explores the challenges and practices of knowledge sharing in various e-learning settings. This review is expected to help both e-learning and knowledge management communities understand knowledge sharing needs and challenges and provide suitable solutions for the e-learning context.

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Digital Transformation in Information Systems Curricula: A Keyword Analysis

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Abstract

Modern digital technologies are advancing rapidly, driving transformative changes. For Information Systems (IS) educators, maintaining curricula that prepare graduates for the digital economy is imperative. This study developed a knowledge pool of 121 common keywords in digital transformation through literature review and investigated their application in the titles and descriptions of 4,093 IS courses across 315 undergraduate programs in the United States. The findings illustrate how IS educators conceptualize the digital transformation within the IS discipline and incorporate it into curricula. Additionally, the results offer insights for educators aiming to develop course content on digital transformation and update IS undergraduate curricula to align with the demands of modern enterprises in the era of digital transformation.

Keywords: Digital Transformation, IS curricula, IS Course Design, IS Curriculum Development

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Digital Transformation in Information Systems Curricula: A Keyword Analysis

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1. INTRODUCTION

As businesses embrace new digital technologies, they require Information Systems (IS) professionals competent in designing, developing, and managing modern technologies. IS educators continuously face the challenge of assessing and updating their curricula to meet the demand for workforce-ready graduates.

A systematic literature review (Feng and Salmela, 2020) indicates consistent rigor in IS curriculum studies over the last decade. These studies are categorized as normative and descriptive (Hwang et al., 2015). Normative studies aim to identify factors affecting IS curriculum design, while descriptive studies focus on describing IS courses or programs. A common theme in descriptive studies is evaluating the state of undergraduate IS curricula, accomplished through comprehensive surveys of IS programs in countries like Canada, India, U.K. or U.S. or those affiliated with accreditation bodies such as AACSB or ABET (Kung et. al, 2006; Stefanidis and Fitzgerald, 2010; Harrington & Larson, 2012; Yang, 2012; Bandi et al., 2014 These studies provided either a descriptive snapshot of the entire IS curricula or an overall mapping to a model curricula such as IS 2010. This study takes the same approach to examine the undergraduate IS curricula in the United States, but with a focus on how its course content, defined as course title and course description, addresses digital transformation.

This paper is organized as follows: Section 2 discusses digital transformation, Section 3 explains the methodology for creating the keyword pool and IS curricula dataset, Section 4 presents the analysis of results and discussion, and Section 5 provides conclusions, limitations, and recommendations for future research.

2. DIGITAL TRANSFORMATION

Businesses have been transformed by digital technologies characterized by pervasiveness of social media, proliferation of mobile devices and apps, optimization of data value through analytics, and virtualization of computing resources in the cloud.

The convergence of social media computing, mobility computing, data analytics, and cloud computing is known as the SMAC technology stack in contemporary IT architecture. This stack has been identified as the 3rd Platform of Computing by IDC (Gens, 2013), the Nexus of Forces by Gartner (Plummer et al., 2012), and the fifth wave of corporate IT by technology futurists (Evans, 2013). In IDC's term (IDC, 2017), the 3rd platform evolution will be further fueled by the emerging innovation accelerators such as IoT, AI, robotics, AR/VR, 3D printing, and blockchain. Example applications include intelligent home appliances, self-driving cars, robots, wearables, and other applications.

Digital transformation fundamentally revolves around the digitization of analog data, the digitalization of business processes and models, and the transition from physical to digital in product and service design. Being "digital" is a key driver in the strategic planning and operation of modern organizations. In the sense of business being deliberately transformed, digital is a "mindset that seeks to leverage technology, data, and ways of working to establish new business and service models for the achievement of a higher purpose and value" (Tardieu et al, 2020).

The definitions of digital transformation vary greatly. Trying to unify the definitions, Gong and Ribiere (2020) defined digital transformation, at its highest level of abstraction, as "a fundamental change process, enabled by innovative use of digital technologies, accompanied by strategic leverage of key resources and capabilities, aiming to radically improve an entity and redefine its value proposition for its stakeholders". From a multidisciplinary perspective, the scope of digital transformation should at least include "information systems, strategic management, marketing, innovation, and operations management" (Verhoef et al., 2019). "Digital Transformation," "Business Transformation," and "Digital Business Transformation" are terms used interchangeably.

Modern organizations adopting this new fusion of technologies require IS professionals knowledgeable in helping with digital transformation. To address workforce demands, IS educators are encouraged to design and develop curricula that include digital transformation course content. This study examines how IS educators conceptualize the digital transformation phenomenon and integrate it into IS undergraduate programs in the United States by identifying and analyzing keywords used in course content.

3. METHODOLOGY

This study developed a pool of keywords related to digital transformation to analyze the course content, titles and descriptions, of undergraduate IS programs in the United States.

The Keyword Pool

Digital transformation is a relatively new field lacking a universally accepted, holistic framework (Kutzner et al., 2018; Lassnig & Klieber, 2022; Gao et. al, 2022). Without such a framework, researchers often adopt an abstract approach, conducting independent literature reviews to identify key knowledge keywords, terms, or themes for validating the sensitization and conceptualization of digital transformation (e.g., Henriette et al., 2015; Kutzner et al., 2018; Nadeem et al., 2018; Hausberg et al., 2019; Verhoef et al., 2019).

A literature review of IS/IT articles published between 2010 and 2022, containing "Digital Transformation" in titles or abstracts, was conducted to develop a keyword pool for this study. As shown in Appendix A, the review identified 121 keywords in fifteen knowledge subjects, categorized under four conceptual constructs. These keywords encapsulate the nature, essence, and uniqueness of digital transformation.

In summary (knowledge subjects italicized and conceptual constructs highlighted in bold), digital transformation, driven by a **digital platform**, fosters *digital generativity*, allowing the addition of new capabilities post-design and production. Such a platform facilitates a highly *heterogeneous* mix of social networks, mobile devices, and cloud infrastructures, ensuring real-time, ubiquitous *digital connectivity*. Employing modern *digital software engineering* practices, **digital systems** in this transformation use *software-defined infrastruc*ture, adopt *service-oriented computing*, enhance *digital user e*xperience, and enforce *digital security*.

Digital transformation brings *digital effects* in which data is massively digitized, the physical materialization is turning to digital materialization in product design, and business processes and models are being digitalized. Consequently, vast **digital data** is generated and stored in the cloud, maximizing its value through *data analytics*. Success in digital transformation necessitates proficient **digital management**, guided by *transformative IT leadership*, fostering *digital strategies, digital technology convergence*, and *digital innovation*, ultimately evolving an organization into a *software-driven enterprise* or *digital business.*

The IS Course Dataset

To ensure consistency, this study focused on business and management schools, which are the typical contexts for IS undergraduate education. These schools generally require students to complete predefined business courses along with a fixed set of core courses or common core courses and electives in one or more specialization areas.

The study first compiled a list of 771 business and management schools in the U.S., including accredited, non-accredited, public, and private institutions, as listed in univsource.com, wikipedia.com, allBusinessSchools.com, and other websites. Out of these schools, 335 IS-related programs such as Information Systems, Computer Information Systems, Business Information Systems, Management Information Systems, and so on were identified. A content review of each program's website and/or online catalog was then conducted from June 2022 to March 2023, identifying 4093 IS courses.

Data, including course catalog number, title, and description, were compiled into an Excel worksheet for categorization, analysis, and summarization. This worksheet was also converted into a Microsoft SQL Server table for further course content analysis.

4. RESULTS AND DISCUSSION

To gain a deeper understanding on how IS educators conceptualize digital transformation phenomenon within the IS discipline and its integration into curricula, this study tallied occurrences of 121 digital transformation keywords in titles and descriptions of the 4093 IS courses. Categorized by the four digital transformation constructs, 75 keywords that appear at least once in the IS course titles and/or descriptions are listed in Appendix B.

Digital Transformation as a Keyword

This study first observed the usage of three forms of digital transformation keywords: "Digital Transformation," "Business Transformation," and "Digital Business Transformation" in course content. Despite calls to teach Digital Transformation as a standalone course in higher education (Moreira et al., 2017; Dang & Vartiainen, 2022), only two such courses were found in IS curricula: *Digital Business Transformation* and *Technology-Enabled Business Transformation*.

As detailed in Appendix C, these courses emphasize the importance of "alignment of process, people, and technology" to "support and innovate business strategies," and teach students "a managerial understanding of applications, emerging technologies, skills sets, business concepts, and strategic opportunities that organizations need to master in order to plan, manage, and lead companies through the process of digital business transformation". Although these two courses do not cover all aspects of Digital Transformation, they are indeed courses that teach Digital Transformation.

Though the three digital transformation keywords feature only in two course titles, they are present in descriptions of six additional courses: *Management of Technology and Innovation, Business Dynamics, Enterprise & Supply Chain Management Systems, Management of Information Systems, Business Process Automation,* and *Design Thinking*. These courses, as per their descriptions, acknowledge the rapid and competitive evolution of today's business landscape, fueled by transformative technologies, and each addresses challenges from a particular perspective of digital transformation:

- The *Strategic Management of Technology and Innovation* course recognizes the innovative nature of digital technologies and teaches students how to apply the technologies to create innovative digital experiences, products, and services.
- Knowing the impact of digital technologies on business processes, the *Business Process Automation* course shows students how mapping and automating business processes can improve digital transformation.
- The *Management of Information Systems* course seems to be a traditional Management Information Systems (MIS) foundation course but with a focus on the role of IS managers in digital transformation.
- In the *Design Thinking* course, students learn how to design or re-design existing products, services, and business models for digital transformation.
- The *Business Dynamics* course introduces the "systems thinking" approach to master the complexity in Digital Transformation.
- Emphasizing the importance of process integration within an enterprise, the *Enterprise & Supply Chain Management Systems* course focuses on digital transformation occurring within the firm and across the firm's supply chain.

Transformation as a Keyword

Attention was also given to "Transformation" as a standalone keyword with a broader scope to understand if Digital Transformation is conceptualized differently in this IS curricula dataset. Results showed that this keyword appears in one course title: *Enterprise Strategies and Transformations* (see Appendix C). Although the course emphasizes "integrative strategies spanning all business functions" for evolving enterprises, it does not explicitly state the concept of digital transformation in the description.

At the same time, "Transformation" appears 22 times in course descriptions other than those discussed above. A review of these descriptions reveals that "Transformation" is mostly used in the context of Data Warehousing, where it is an element of the data extraction, transformation, and loading (ETL) process. Other instances illustrate the process of raw data being transformed into information for data analytics in subjects such as Data Management and Business Intelligence. This usage does not principally refer to digital transformation.

However, two courses are found to teach digital transformation but use only the keyword "Transformation" in the course description. One course, *E-Commerce*, teaches "the transformation of businesses to be technologically competitive in the 21st century" using "major software systems like customer relationship management, supply chain management, big data, cloud technologies, and the Internet of Things". Another course*, IT Strategy: Disrupting Norms*, emphasizes "managerial and industry issues with a focus on the transformations of business models" due to technological disruption.

Digital as a Keyword

The core concept of digital transformation is "Digital". The origins of the word "digital" date back to late 15th century (Holden, 2023), but its usage became more widespread as a direct result

of modern computing in the twenty-first century. Today, the word "Digital" is used in conjunction with many other words to convey a concept or subject using binary digits (Digital, 2023). As shown in Table 1, the study found that the keyword "Digital" is associated with 16 other words in 34 course titles. A review of these course descriptions reveals the following facts:

Digital Enterprise	Digital Commerce
Digital Business	Digital Economy
Digital Entrepreneurship	Digital Marketing
Digital Innovation	Digital Market
Digital Services	Digital Security
Digital Product Management	Digital Forensics
Digital Business Design	Digital Analytics
Digital Solutions	Digital Media

Table 1 "Digital" in Course Titles

- Several courses recognize the fact that businesses in the digital transformation era are operating in the digital environment such as the digital market (e.g., *Data-Driven Decisions in Digital Markets*), the digital commerce (i.e., *Digital Commerce and IoT Analytics*), or digital economy (i.e., *Analytics and the Digital Economy*).
- A few courses refer to businesses that leverage digital technologies as digital business (e.g., *Global Perspectives on Digital Business*) or digital enterprise (e.g., *Foundations of the Digital Enterprise*).
- Three courses, *Digital Entrepreneurship*, *Digital Entrepreneurship and Innovation*, and *Managing Digital Services and Innovation*, bring together the state-of-the-art knowledge in digital business practices using innovative digital technologies.
- Several courses refer to the agile methodology for digital transformation - the *Digital Product Management* course teaches project management for digital projects, the *Analysis and Design of Digital Solutions* course focuses on the development of digital solutions, and the *Digital Solutions with AI* course further discusses the solutions with the use of AI.
- Based on its description, the *Digital Business Design* course teaches digital transformation to a large extend in that the students "bring together knowledge of digital technologies and their skills in business design and development to create innovative, leading-edge processes, products, and services for today's modern organizations".
- Among 264 courses that contains the word Security or Cybersecurity in this curricula dataset, there is only one course titled *Digital Security*. The description of such course, however, does not explicitly address the new and higher level of security risks created by digital transformation (Shahim, 2021).
- Even though the terms Computer Forensics and Digital Forensics are often used interchangeably, the *Digital Forensics* courses cover a broader range of examination and analysis of not only computers but also mobile devices and digital networks that expand security surface in digital transformation.

Keywords in the Four Constructs

As shown in Appendix B, most of the keywords with the highest number of occurrences appear in the Digital Data construct (56.7%), followed by the Digital Systems (27.8%), Digital Platform (11.1%), and Digital Management (4.4%). This indicates that a large amount of digital transformation context in this IS curricula dataset covers the Analytics pillar of the SMAC technology stack. This finding also corresponds to the most common pattern of the SMAC convergence (Meegan et al., 2013; Niu, et al., 2021) in which mobile devices serve as front-end platform, social networks add a layer of rich information, cloud services provide underlying infrastructure, and most importantly, data analytics enables business to reach its goal of making intelligent data-informed decisions.

Digital Platform

In the Digital Platform construct, the Social, Mobile, and Cloud technologies of the SMAC stack receive a lot of attentions in the course context. Among them, the Cloud keywords (i.e., *Cloud Computing*, *Cloud Service*, *Software as a Service*, *Cloud Security*, *Cloud Technology*, *Cloud Deployment*, *Infrastructure as a Service*, *Platform as a Service*, *Software-Defined Network*) appear the most. Thus, IS educators might also recognize the fact that the efficacy of the three digital transformation drivers, the social solutions (email and social media), the Big Data solutions (data backup and storage), and the mobile apps, are all heavily dependent on the cloud provisions (Gens, 2013).

Digital Data

Digital data and analytics receive most attention from IS educators. In Digital Data construct, three common keywords of Business Analytics, Business Intelligence, and Data Analytics are generally used interchangeably. Analysis of course data shows that these keywords are typically used in title of survey courses including (number of occurrences in parentheses) Business Analytics (95), Business Intelligence (89), and Data Analytics (47). Keywords in more specialized

areas, such as Big Data (33), Machine Learning (14), Social Media Analytics (4), and Text Mining (3), also appear in a number of course titles. Although the origin of Data Mining (51) and Data Warehousing (23) dates to the late 1980s, it is recent digital transformation movement that appears to amplify its importance and popularity because of more open, flexible, and cost-effective technologies, such as IoT and AI, that employ more advanced statistical algorithms.

Digital Systems

There are some interesting findings in the Digital Systems construct. First, Web APIs and Web Services are found, not surprisingly, to be taught in the IS programs to meet the two major implementation demands of the Service-Oriented Architecture (SOA) which is being recognized as one of the key enablers of digital transformation (Gedela & Valurouthu, 2016; Fischer et al., 2020). However, in this curricula dataset, the emerging Microservices have not yet been explicitly integrated into any IS course.

Second, software engineers in the digital transformation era face the challenge of being more agile and responsive (Rigby et al., 2016; Paterek, 2018). As found in 10 course titles, Agile Methodology is now being taught not as a module in the traditional System Analysis and Design course but solely in standalone courses including, for example, *Software Development with Agile Methodologies*, *Agile Web Design & Development*, *Agile Project Management*, *Agile Application Development*, and *Agile Principles of Software*.

Third, Python for its versatility is heavily used in the industry not only for website and software development but also for data analytics, data visualization, and software-defined networks. Python as a keyword appears 116 times with 10 occurrences in the course titles. In contrast R, as another programming language for statistical calculation and data visualization, appears only in one course title as "Introduction to R for Analytics". Interestingly, neither Python nor R have taken over the de facto Java which appears 154 times in course content with 88 occurrences in course titles.

Finally, Artificial Intelligence, once a sub-discipline in Computer Science but now a crucial technology enabler for digital transformation, appears 33 times in the course content with 5 in the course titles such as *Artificial Intelligence Application in Business*, *Business analytics & AI*, *Artificial Intelligence in Business*, *Topics in Information Systems: Digital Solutions with AI*, and *Artificial Intelligence Business Strategies and Applications*.

Digital Management

Because successful digital transformation requires the development of new software, every business could become a digital business largely controlled by software (Holmes, 2019). From the literature review conducted in this study, the business engaging with digital transformation is commonly called Digital Business or Digital Enterprise. In this course dataset, Digital Business or Digital Enterprise appears 14 times in the course context with 6 in course titles such as *Global Perspectives on Digital Business*, *Digital Business Technologies*, *Digital Business Transformation*, *Digital Business Design*, *Digital Business Lab Design*, and *Foundations of the Digital Enterprise*.

The keyword Digital Technology was also found in use 10 times in course descriptions and 3 times in the course titles including *Digital Technology*, *Digital Technologies for Business*, and *Digital Technologies: Strategy and Use*. The digital technologies being employed in digital transformation would be described more accurately as "digital" rather than "informational". However, it remains to be seen whether the use of Information Technology as an umbrella term in IS curricula (Leidig & Salmela, 2022) would be largely replaced by Digital Technology.

In digital transformation, digital technologies expand their digital capabilities beyond internal dimensions from redefining products and services to reengineering business process and models to create disruptive innovations (Ciriello et al., 2018). Digital Innovation appears in thirteen course titles including *Digital Innovation*, *Global Digital Innovation*, *Management of Digital Innovation*, *Digital Entrepreneurship and Innovation*, *Managing Digital Services*, *IS Innovation and New Technologies*, and other titles.

The keywords in the Digital Management construct appear the least. Thus, the course content in this curricula dataset reflects that IS educators might consider digital management as less critical than the digital technology itself. In the long run, however, mismanaged digital transformation might contribute to the failure of digital transformation (Baskin, 2018; Tardieu et al., 2020; Ramesh & Delen, 2021).

5. CONCLUSIONS, LIMITATIONS, AND RECOMMENDATIONS

With proliferation of innovative digital technologies, modern organizations are increasingly embedding technology across their business processes and integrating them into products and services to drive fundamental change for organizational improvements and redefining their "value" proposition. This rapid assimilation of digital technologies in different business contexts has necessitated a corresponding evolution in Information Systems (IS) education.

To explore the coverage of digital transformation content in IS curricula, this study developed a knowledge domain of 121 common keywords on digital transformation and used the keywords domain as a lens for a descriptive analysis of titles and course descriptions of 4,093 Information Systems courses in 315 Information Systems undergraduate programs in the United States.

The study's results illuminate a critical gap between the need for digital transformation competencies in the workforce and the current state of IS curricula. Despite a pervasive use of the term "digital," a granular application of digital transformation principles in course content is often lacking.

The prevalence of analytics-focused content underscores the priority given to data-driven decision-making in the curriculum, yet there is an evident need for a more integrated approach that encompasses the entire SMAC (Social, Mobile, Analytics, Cloud) stack and aligns with modern business infrastructures.

Given the low representation of digital management concepts, IS curricula should integrate more content that addresses the strategic aspects of digital transformation, preparing graduates to lead and manage change in digital-centric businesses. More specifically, to ensure comprehensive curricula coverage, educators should introduce courses that cover the managerial aspects of digital transformation, such as change management, digital strategy, and innovation leadership. They should also incorporate practical case studies and capstone projects to help students understand the real-world implications of managing digital transitions within organizations. Furthermore, encouraging an interdisciplinary collaboration with business, technology, and design disciplines can foster a holistic understanding of digital management.

Limitations of the Research

This study has several limitations. Firstly, to ensure consistency, it focuses exclusively on business and management schools that adhere to a traditional educational setting, requiring students to complete a standard set of business courses, alongside core classes and electives within certain specializations. This focus excludes coverage of digital transformation in alternative settings such as Schools of Information Technology, and departments of Information Science or Computer Science. Secondly, the lack of a universally recognized framework for digital transformation means that the analysis of course content is based on the authors' interpretations derived from their literature review. Lastly, the study recognizes the potential discrepancy between course titles and descriptions and the actual material delivered by Information Systems educators, which may be attributed to delays in updating curriculum catalogs.

Recommendations for Curricula Development

Recommendations for curricular development include the compliance with IS2020 Model Curricula, and the alignment with accreditation standards.

Future curriculum development should be benchmarked against the IS2020 Model Curricula to ensure the inclusion of essential competencies for digital transformation, emphasizing an agile, technology-fluent mindset. For example, courses should be designed or updated to map directly to the competencies outlined in the IS2020 Model, ensuring that each course contributes to the development of a specified skill set. The updated curricula should also emphasize agility and flexibility in technology use, reflecting the rapid evolution of digital tools and platforms in the business world. Furthermore, regular assessments of curricula against the IS2020 Model guidelines should be implemented with feedback loops allowing for continuous improvement.

For schools seeking or renewing AACSB accreditation, there is an imperative to align IS curricula with standards that mandate the delivery of contemporary, technology-forward content to ensure learner success in the digital economy. To that end, it is recommended that educators benchmark their curricula against AACSB standards, particularly Standard 4, to ensure the content remains current and relevant. Programs can also use accreditation reviews as a feedback mechanism to highlight strengths and address areas for improvement in digital

transformation education. Finally, schools should invest in faculty development programs on the latest digital transformation practices and pedagogical approaches.

Recommendations for Future Research

Digital transformation is a relatively new field of research with only a few studies focusing on IS curricula. One area of future research is to examine digital transformation in IS curricula through the lens of the new IS2020 Model Curricula. The new competency based IS2020 curriculum guidelines define 10 required and 9 optional competency areas, for a total of 19 areas of competency for IS education (Leidig & Salmela, 2022). Future studies could examine the occurrences of digital transformation keywords across required and optional competency domains to provide insights for curricular updates in the context of the IS2020 Model Curricula.

Another avenue for future research is to investigate how AACSB accreditation influences the integration of digital transformation in IS curricula, providing a framework for curricular excellence in digital competencies. AACSB accreditation is a rigorous, external peer-review process that ascertains curricular and programmatic quality of business schools. With the new 2020 AACSB standard for Learner Success (Standard 4. Curriculum), business schools are expected to deliver curricular content that is current, relevant, forward-looking, and aligned with program competency goals (AACSB, 2022). More specifically, Standard 4 addresses the need for learners to be agile with current technologies and possess technological agility for workforce readiness in a digital transformation era. Future research should assess whether AACSB accreditation correlates with a higher quality of digital transformation content and better student outcomes. Future studies could also identify innovative curricular practices from AACSB-accredited programs that could serve as benchmarks for other institutions.

Finally, it is recommended to extend keyword analysis to explore the presence and depth of digital transformation content in IS graduate programs, including MBA curricula, to inform the development of programs that produce leaders adept at driving digital innovation. More specifically, future studies could: 1) evaluate how deeply digital transformation is embedded in graduate IS and MBA programs, particularly in areas like strategic planning and digital leadership, 2) investigate how graduate programs differentiate themselves by integrating digital transformation and which approaches are most effective in preparing leaders, and 3) conduct longitudinal analysis to track the career progression of graduates from programs with strong digital transformation elements in order to assess the long-term impact of graduate education.

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Appendix A
List of Digital Transformation Constructs, Subjects, and Keywords

Digital Transformation Constructs and Subjects			
Digital Platform	**Digital Systems**	**Digital Data**	**Digital Management**
Digital Heterogeneity	Digital Security	Data Analytics	Digital Business
Digital Connectivity	Digital Software Engineering	Digital Effect	Digital Strategy
Generative Technology	Digital User Experience		Digital Technology Convergence
	Service-Oriented Computing		Digital Innovation
	Software-defined Infrastructure		Transformational IT Leadership
			Software-driven Enterprise
Digital Transformation Keywords in Alphabetical Order			
Agile methodology	Data Mining	Digital process automation	Network effect
Agile project management	Data Science	Digital security	No-Code development
Agile software development	Data Warehouse	Digital Software Engineering	Platform as a Service
Amazon Web Services	Data Warehousing	Digital strategy	Process automation
Application as a Service	Democratization of technology	Digital system	Process mining
Web API	DevOps	Digital technology	Python
Artificial Intelligence	Digital age	Digital Transformation	R
Augmented Reality	Digital application	Digital user experience	Rapid Application Development
Big Data	Digital business	Digital velocity	Service broker
Blockchain	Digital Business Transformation	Digital veracity	Service-Oriented Architecture
Bring Your Own Device	Digital company	Digital volatility	Service-Oriented Computing
Business Analytics	Digital connectivity	Digitalization	Social Computing
Business Intelligence	Digital convergence	Digitization	Social media analytics
Business Process Automation	Digital data	Disruptive innovation	Social network
Business Process Reengineering	Digital devices	Enterprise application services	Social network monitoring
Change management	Disruptive Technology	Enterprise Data Architecture	Social network security
Citizen developer	Digital economy	Generation D	Software as a Service
Citizen Development	Digital ecosystem	Generative technology	Software-Defined Infrastructure
Cloud Computing	Digital effect	Infrastructure as a Service	Software-Defined Network
Cloud data platform	Digital engineering	Innovative business model	Software-Defined Storage
Cloud deployment	digital environment	Innovative business process	Software-driven enterprise
Cloud security	Digital Generation	Internet of Things	Software-driven service
Cloud services	Digital generativity	Internetification	Text mining
Cloud technology	Digital Heterogeneity	Low-code Development	Transformational IT leadership
Cloud transformation	Digital infrastructure	Machine Learning	Transformational leadership
Collective intimacy	Digital innovation	Master Data Management	Transformation management
Consumerization of IT	Digital marketing channels	Materialization	Virtual Reality
Customer centric	Digital maturity	Microservices	Web Services
Customer intelligence	Digital mobility	Mobile Computing	
Data Analytics	Digital modernization	Mobile security	
Data Lake	Digital platform	Mobile technology	
		Natural Language Processing	

Appendix B
Keyword Occurrences by Keyword Constructs

Digital Platform	A[1]	T[2]	Digital Data	A	T	Digital Systems	A	T	Digital Management	A	T
Cloud Computing	73	21	Business Intelligence	203	89	Python	116	31	Change management	14	
Social Media	52	14	Business Analytics	187	95	Application Programming Interface	92		Digital Technology	13	5
Blockchain	26	10	Data Mining	181	51				Digital Business	11	3
Social Network	20		Data Warehousing	137	23	Mobile App	91		Digital Solution	6	
Cloud Service	8		Data Analytics	132	47	Agile Methodology	60	10	Digital Transformation	6	3
Mobile Computing	7		Big Data	105	33	Amazon Web Service	46		Digital Innovation	5	2
Software as a Service	7		Machine Learning	59	14	Artificial Intelligence	34	4	Business	5	2
Cloud Security	4		Data Science	34	13	Web Service	32		Transformation	4	
Mobile Technology	3		Neural network	22		R Language	20	1	Business Process	4	1
Cloud Technology	2		Text Mining	19	3	Internet of Things	16		Engineering Process Automation	3	
Digital Device	2		Social Media	9	4	Rapid Application Development	11	1	Digital Enterprise	3	
Digital Platform	2		Analytics	3					Digital Economy	2	
Digital Security	2		Digital Data	2		Service-Oriented Architecture	5		Business Process Automation	2	
Cloud Deployment	1		Digitization	2					Digital Strategy	2	
Infrastructure as a Service	1		Master Data Management	2		DevOps	4		Digital age	1	
Mobile Security	1		Google Analytics	1		Natural Language Processing	3		Customer Centric	1	
Platform as a Service	1		Data Lake	1		Low-code development	3		Network Effect	1	1
Social Computing	1		Digitalization			Digital Product Management	1		Process Mining	1	
Software-Defined Network	1					Augmented Reality	1		Bring Your Own Device	1	
Digital network						Digital Application	1		Process Mining	1	
						Virtual Reality	1		Digital Business Transformation		
215 (11.1%)			1099 (56.7%)			584 (27.8%)			86 (4.4%)		

[1] Total number of occurrences in both course title and course description [2] Total number of occurrences in course title

Appendix C
Courses with Digital Transformation in the Description

Digital Business Transformation: Recent advances in computers, information and communication technologies have created new global electronic trading and communication infrastructure that affects organizational strategies, market structures, and industrial organization around the world. Managers need deep understanding of twenty-first century business models and how to align new technology with changing business processes and new ways of organizing businesses in the digital age. This course provides a managerial understanding of applications, emerging technologies, skills sets, business concepts, and strategic opportunities that organizations need to master in order to plan, manage, and lead companies through the process of digital business transformation.

Technology-Enabled Business Transformation: It does not matter(;) it's what you do with it! Business in the 21st century runs on it. However, competitive advantage seldom comes from having exclusive or proprietary access to a technology. Rather, it comes from more effectively utilizing technologies to which everyone - including the competition - has access. The implications of this reality are many. First, it is necessary to understand what technologies are available in the marketplace and their capabilities. Next, and far more challenging, it is necessary to understand how these capabilities may positively (or negatively) interact with business strategy. Business transformation is the alignment of process, people, and technology such that it can both support and innovate business strategies. Given that technologies evolve and develop at a rapid pace, it is necessary for managers to understand what technologies can do (both established and new) and how it can be leveraged to create real value.

Strategic Management of Technology and Innovation: Provide students with concepts and frameworks for identifying, assessing, creating, and managing technology-enabled innovation in organizations. Include innovation process, the framework to identify, assess, create, and implement innovation in organizations, digital transformation of organizations, managing changes, and tools for prototyping. Through projects, learn how to apply technologies to create innovative digital experiences, products, and services.

Business Process Automation: Students map current business processes and identify areas for software automation utilizing Excel VBA; how mapping and automating business processes can improve an organization by providing for simplified workflow, digital transformation of existing processes, increased service quality, improved service delivery, or reduced costs.

Management of Information Systems: Roles of information systems managers and executives in digital transformation for business processes and outcomes. Strategy and techniques in development and deployment of information systems for sustainable competitive advantage. Ethical, organizational, social opportunities and challenges inherent in information systems management.

Business Dynamics: Managers and business leaders need to make sense of a complex and fast-changing business landscape. They need to map, analyze, and manage complexity to achieve superior performance. This course introduces systems thinking, as well as associated modeling methods, techniques, and software tools that are essential to master complexity and drive business performance. The course explores models, model-based thinking, complex system dynamics, network dynamics, and other computational modeling approaches. These skills can be used to understand system structure and dynamic behavior across a variety of business domains and applications, including business transformation, digital transformation, business model design, and sustainability. Case studies across a variety of industries and a group project add to the student learning experience.

Design Thinking: Design thinking refers to a transformation and problem-solving approach that emphasizes strong user orientation and agile iterations with multidisciplinary teams. Aiming to create ideas and solutions that are emotionally meaningful, functional, and economically viable, "design thinking integrates the needs of people, the possibilities of technology, and the requirements for business success ." Design thinking is applicable to both start-ups and mature organizations to design new offerings or re-design existing teams, products, services, business models, or platform ecosystems. Adopting a hands-on and experience-based learning approach, this course introduces design thinking to business undergraduate students. Through lectures and case discussions students will learn about the design thinking process and the applications of design thinking for digital transformation across a variety of industries. Students will also work in teams to participate in a design challenge project.

Enterprise & Supply Chain Management Systems: This course emphasizes the importance of integration of processes within an enterprises and across enterprises in a supply chain and the systems used to support these processes. Enterprise systems support the internal logistics chain within a firm integrating processes across all functions. Students will learn about the digital transformation taking place within the firm and across the firm's supply chain. The course will introduce students to processes and systems that firms use to harness the capabilities of their supply chain partners and supply networks.

Enterprise Strategies and Transformations: Organizational transformations are critical for continued market success in an increasingly complex and dynamic global environment. Emphasizes integrative strategies spanning all business functions which are needed by evolving and established enterprises.

Teaching Case

Generative AI in practice: A Teaching Case in the Introduction to Management Information Systems class

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"With how generative AI is evolving, it seems clear that my next hire is going to be a prompt engineer" (Head of global marketing for large multinational software company, 2023). A prompt engineer is someone who writes the prompts for the future of work in an AI-generated world. This teaching case presents two ways to bring generative AI into the classroom, and introduces students to prompt writing.

Abstract

Since ChatGPT exploded onto the scene in October 2022, the media has been breathless with their discussion about how it is going to impact many aspects of life and work. In order to bring this new reality of generative AI into the *Introduction to Management Information Systems* classroom at both the undergraduate and graduate levels, we have developed two short cases that can be completed in or out of the classroom. These cases allow students to use generative AI for an interesting and useful purpose and develop prompts to deliver the output. Students can begin to learn what generative AI can do for them, and how it can shape their future careers. We tested the perceived effectiveness of the project on students using a pre/post survey. The results are analyzed using a paired t-test and demonstrate that students increased their understanding of generative AI and prompt engineering.

Keywords: Generative AI, ChatGPT, Future of work, Prompt engineering, Business process

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Generative AI in practice: A Teaching Case in the Introduction to Management Information Systems class

David Firth and Jason Triche

1. INTRODUCTION

Artificial intelligence is changing job roles at a pace that often exceeds the human capability to adapt (Topi, 2019). "With how generative AI is evolving, it seems clear that my next hire is going to be a prompt engineer" (J. Santucci, personal communication, April 3, 2023). A prompt engineer is someone who knows how to get the most out of generative AI, such as ChatGPT, by using specific and useful prompts. There are already YouTube videos on how to do prompt engineering with multi-millions of views (e.g. https://www.youtube.com/watch?v=jHv63Uvk5VA)/ The "next hire" quote led us to reevaluate what we are teaching in our Introduction to MIS class. As a result of this conversation, we created a teaching case (i.e., final project) in order to help students understand how they could use generative AI to complete important personal and business tasks. The project also uses elements that require the skills of a prompt engineer. This teaching case is about a single class project that can be incorporated into an undergraduate or graduate introduction to information systems class, or a communications class. It is a high-level project designed to get students starting to think about and using generative AI.

We first introduce students to the basics of generative AI, and some of the different types of generative AI. We then have the students work through two different ways to use generative AI. The first part of the project is to create a video that comes entirely from text prompts. The second part of the project is to start with their resume, and use a C.R.A.F.T. framework (Content at Scale, 2023) to take the output from ChatGPT, or other generative AI platform, to create a cover letter for a job application. Across two semesters we had students complete the video-from-text assignment outside of class, and the cover-letter-from-ChatGPT in class one semester and outside class the second semester. The projects work equally well completed in or out of class is our conclusion.

2. PROJECT PREWORK

We start class by first asking students if, by a show of hands, they have used ChatGPT or other generative AI. From this we ask several of these students to tell us what task they have used generative AI for, and what was the name of the generative AI they used. Currently, typical platforms mentioned are ChatGPT, Stable Diffusion, Midjourney and Dall-E, but the list is expanding daily. For instance, Microsoft is deploying Co-pilot for its Microsoft Office suite, and this will undoubtedly become a routine answer to this question.

We next introduce the term generative AI to the class and ask students for their input as to what *generative* means. We take it for granted that students know that AI stands for Artificial Intelligence, but it is still worth mentioning in passing.

Q: What does the term *generative AI* mean?
A: Generative artificial intelligence or generative AI is a type of artificial intelligence (AI) system capable of generating text, images, or other media in response to prompts. Generative AI models learn the patterns and structure of their input training data, and then generate new data that has similar characteristics (Government Accountability Office, [GAO], 2023).

We then give a simple example of what it means when we say, "Generative AI models learn the patterns and structure of their input training data." To do this, we describe simple machine learning. We tell students that the Generative AI models learn by being shown things, letting them guess or deduce the answer using their programming, and then confirming whether the answer is correct or not. For instance, a picture of a cat is one type of input training data. The generative AI should guess this correctly as a cat. If it does not, then it is told that the guess was incorrect. Over time, the generative AI learns what a photo of a cat looks like. From there, generative AI can create new content, as it now knows what a cat looks like. It is worth noting, we actually use the term ChatGPT rather than generative AI, as it seems easier for students to understand the concept with a specific tool.

It is possible at this point to go into an extensive

discussion of the ethics of AI input training data. Although not part of case we are discussing in this paper, we usually talk about two particular cases where AI input training data to solve a problem actually caused more problems. The two cases we discuss are when Google used historic hiring information about Google engineers to train it's AI to be non-biased in the hiring process, only to find that the AI had quickly learned that the historic hiring of engineers at Google was based on a) graduated from Stanford, b) in computer engineering, c) was male, and d) was white. The second example is Wells Fargo, who wanted to fix the fact that loans were being made preferentially by loan agents (who were typically white) to white people. The AI training was specifically told to avoid race as part of its learning process, but quickly figured out from historical loan data that it could substitute zip code as a proxy for race, and so continued the race-biased lending that Wells Fargo was specifically trying to avoid by using AI in the hiring process.

We have also found it useful to use one, or both, of the following publicly available videos to introduce the topic of generative AI. The first is from CNBC and is titled *Why OpenAI's ChatGPT Is Such a Big Deal* (CNBC on YouTube at https://www.youtube.com/watch?v=pOmpqdlVCoo uploaded February 2023). The second is from Microsoft, and is titled *Introducing Microsoft 365 Copilot with Outlook, PowerPoint, Excel, and OneNote* (Microsoft on YouTube at https://www.youtube.com/watch?v=ebls5x-gb0s, uploaded March 2023). As with any video in a rapidly evolving space, it is possible, if not likely, that these videos will become dated quickly. Nonetheless, we have found these videos to be useful to provide a base level of understanding for students in the introduction to MIS class.

3. FINAL PROJECT DETAILS

Part 1: Text-generated video

Utilizing the benefits of experiential learning (Kolb, 1984), we asked students to use generative AI to complete a task in order for students to grasp the power of generative AI. In this part of the case study, students are asked to create a video using only text input. In order to make the video useful as a final project for class, the video must answer the question: "What is MIS?" We have found this to be a useful question for students since students have to summarize what they have learned throughout the semester.

Prompt for the assignment:

Describe what Management Information Systems is using a completely AI-generated video.
You will create a photo-realistic avatar from a text prompt, develop a script for your avatar using ChatGPT prompts, translate that text script into a voice using a voice generator, and then put it all together in an AI-generated video. The purpose here is to show that you can create a complete, reasonably realistic video from text alone, with the text itself generated by AI. Appendix A contains the entire Project Description.

In the Project Description (Appendix A) we lay out each step for the students. A survey of our students showed that although one or two had used image generative AI, and several had used ChatGPT for text generation, many had not used any of the tools, and so we provided detailed instructions on which tools to use. It is important to note that we focused on which tools to use and also provided limited instructions on how to use the tools. For instance, for image generation there are a lot of options within the image generation platform that are not necessarily obvious. Hence, we made sure students knew to select "photo realistic" if they were using Midjourney as the tool. For the instructor, it is important that we walk through the steps in advance of sharing the assignment or project with students to verify that the options presented here (Appendix A) are still available, are called the same as our instructions, and that the generative AI tool is still available to use for free.

It is important to note that we did not provide any guidance on what prompts to use inside the image generative AI tool. Our approach for class is that it is appropriate to provide specific guidance as to which tool to use, and also on a specific setting that might not be obvious to someone who has never used the tool, (e.g., select photo realistic), but part of the student learning experience is to try writing the prompts themselves.

Once the student has generated a photo-realistic avatar, we give them instructions to use ChatGPT to generate the text for the assignment, What is MIS? We note in our instructions that the prompt is important. We tell students that the prompt will take some effort, as the real key to ChatGPT is how you structure the prompts. We also caution the students that it will be very obvious whether they put effort into this part, or not, and that the effort and thought put in will affect their final grade. That said, we do tell students that they can start with "Create a narrative script explaining what is MIS?" if they have not used

ChatGPT before.

The next part of the assignment is to turn the text generated from ChatGPT into speech. For this we direct students to the ElevenLabs platform (https://beta.elevenlabs.io/sign-up), which is a versatile AI speech generation software product. We tell students that they might need to edit the narrative that ChatGPT outputs before putting it in to the ElevenLabs text-to-speech generator.

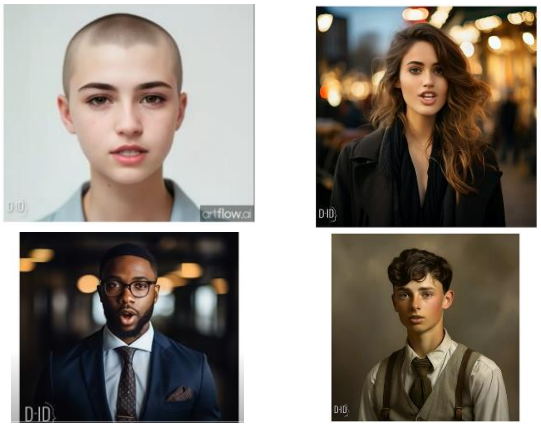
At this point it is worth noting an issue that could arise with the use of generative AI tools such as Midjourney, ChatGPT, Elevenlabs and others can become overloaded, or restrict free use, or both. As such, we asked students to reach out via the course online forum immediately if they were finding that the generative AI tool was not available for free. We also asked students to email us if they were using other generative AI tools other than the ones we were suggesting in our project instructions. This way the instructor can quickly be alerted to any issues with lack of free access to the generative AI platforms, and also this provides a way for the instructor, and from there the students, to learn about other generative AI platforms that are out there.

The penultimate step of the project is to take the photo-realistic avatar created in Midjourney, and the AI-generated voice (itself created from a narrative generated by ChatGPT) and combine them to make a video. For this we directed students to the D-ID platform (https://www.d-id.com).

It is worth making sure that students understand that most of these platforms have only a limited number of tries or credits that are free. That is,

there are limits on how many times you can try things out for free on the platform. The D-ID platform is one such Freemium platform (Anderson, 2008) in that it only allows a limited number of free tries. We alert students to this fact so that they are not surprised and are more likely to be careful with their free credits.

The final step in the project is to upload the AI-generated video output from D-ID to YouTube (www.YouTube.com). We do this for two reasons: 1) As the premier video-sharing platform globally, we feel that students should be proficient in uploading and sharing videos, and this is one way to ensure that every student can do this, and 2) it provides a simple way for students to share their video, including for grading, through the YouTube sharing link. One thing to note here is that we ask students to upload and share an unlisted link. An unlisted link in YouTube means that the video is not searchable and can only be accessed with the exact link. We think that this is important for an assignment that is submitted by the student for a grade.



Links to videos from top left going clockwise

1. https://www.youtube.com/watch?v=H7Gf7hMnMt4
2. https://www.youtube.com/watch?v=i8DFe1XX51U
3. https://www.youtube.com/watch?v=HimMFhk8LoU
4. https://www.youtube.com/watch?v=944_ZYq6bDk

Figure 1 screenshots of created videos

Figure 1 contains screenshots of a small sample of the AI-generated videos answering the question *What is MIS?* from our *Introduction to MIS* class. The links to the actual videos, unlisted, on YouTube have been provided with consent of the students.

Several things are worthy of noting. Firstly, there is an incredibly wide range of avatars being used. Secondly, some of the avatars are close to the student's appearance, others are not close at all. Thirdly, a match between the avatar type and the voice type has an impact on the perceived authenticity of the video. We did not grade for this but did note that when there was a "match" between the avatar type and the voice type, the video did appear much more authentic than when there was no match. For instance, the avatar in Figure 1-4 appears to be a boy from possibly the 1940s. The voice for this avatar was a higher-pitched male English voice, which we found a good match for the avatar. Similarly, we found the voice selection for the avatar in Figure 2 a very good match. We did not include this finding or provide it as part of our instructions, but we do

plan on sharing this information with students in future iterations.

Finally, and critically, qualitative feedback from students showed that having to complete this project, and deliver the final project, made them think about what MIS actually means. This seems to result from watching the final video several times over, although we were not able to confirm this hypothesis. Many of the students also told us that they shared the video they had created with family and/or friends. We see this as a useful way to get the message out about what MIS is to a broad audience.

Part 2: AI generated cover letter

While continuing to use experiential learning (Kolb, 1984), part 2 of the final project is to create a cover letter for an employer based on the student's resume. For this part of the assignment, we had students complete the Content at Scale AIO Writer Certification (https://community.contentatscale.ai/courses) and earn the certificate for the AIO Writer program. Content at Scale is a company that "help[s] marketers, agencies, publishers, and content freelancers adapt to AI content without losing human touch; and we empower them to get 9x more profitable and productive at SEO content." (Content at Scale, 2023).

Given our assignment of using generative AI to create a cover letter from a resume, the focus by Content at Scale on "AI content without losing human touch" seems appropriate. The Content at Scale AIO Writer certificate is a short video-driven, AI-optimization (AIO) course that teaches students some basics about how to use generative AI to create written content. The Content at Scale AIO Writer uses a simple framework built around what they call C.R.A.F.T., which is short for:

1. Cut the fluff. Ruthlessly delete unnecessary content.
2. Review, edit, optimize. Add in more keywords to optimize the content, following your on-page checklist in the Content at Scale app. Read through and make the content better.
3. Add images, visuals, media. Use screenshots, visual data, graphs, etc. where appropriate.
4. Fact-check your content. Never let a fact go without double-checking it.
5. Trust-build with a personal story, tone, and authoritative links (external to other high-quality publications, and internally to your own product or service pages, additional content, etc.).

Our goal is to have students complete a useful task with generative AI, creating a cover letter from their resume, and then use the C.R.A.F.T. framework to improve the output from the generative AI.

Prompt for the assignment (see Appendix B for the full prompt):

1. Sign up for the Content at Scale AIO Writer training
2. Once signed up, complete the AIO Writer Certification
3. Place the Content at Scale AIO Writer certificate in a Word document

Figure 2 Content at Scale AIO Writer certificate

4. Write a cover letter for yourself using ChatGPT. Copy and paste your resume into ChatGPT and ask it to generate "a 1-page cover letter, based on your resume, that has 3 paragraphs, which are "why you", "why me" and "why us." You will also need to tell ChatGPT a precise career role that you are applying for as well so it can try and make this as specific as possible. To be specific as possible, you cannot say 'I want to work at Nike.' You need to say something along the lines of 'I want to work at Nike in the marketing department with a focus on women's athleisure gear'"

Submit that cover letter in the same Word document. In your assignment submission, below your cover letter (which is itself below your AIO Writer Certificate) you must talk about how you used the C.R.A.F.T. framework that you learned in the Content at Scale AIO Writer training. This should cover what order you did things in, and why, from the C.R.A.F.T. framework, and give a description of how the C.R.A.F.T. framework helped you improve the ChatGPT cover letter output. Depending on what the instructor wants to achieve here, this student self-assessment should be changed. For instance, the student could be asked how relevant the cover letter is for the job, and how

comfortable they would be to use the cover letter, and why.

4. FEEDBACK FROM STUDENTS

We collected anonymous survey data from the students (n=58) to test the effectiveness of the project on whether the students learned how to use generative AI and become better prompt engineers. Prior to starting the project, we administered a pre-test survey using a 7-point Likert scale asking questions like "I know how to interact with ChatGPT", "I am aware of the capabilities of ChatGPT", and "I get the results I am expecting from ChatGPT based on my prompt." After the project was complete, we administered the same survey to determine if there were any increases in student capabilities. We used a paired t-test to test for significance between the pre/post survey results.

The results of the survey are in Table 1. The student survey results show that the mean score increased on each of the survey questions. Each increase was very highly statistically significant. An interesting observation to note is although the increase was significant, the mean of "I am good at writing prompts" post-project is still slightly above the neutral on the Likert scale. This result alludes to the fact that prompt engineering is a complex skill and this project only introduces the skill to the students.

Survey Question	Pre-test mean	Post-test mean	Paired t-stat
I am aware of the capabilities of ChatGPT	5.39	6.12	5.8 ***
I know how to interact with ChatGPT	5.03	5.88	5.6***
am good at writing prompts in ChatGPT	3.53	4.70	5.4***
I get the results I am expecting from ChatGPT based on my prompt	4.38	5.16	4.5***

* p<.05, ** p<.01, *** p<.001

Table 1: Student Survey Results

Qualitative feedback solicited from students showed several things:

1. The assignment itself was very useful indeed to most students. Several did not have a cover letter prior to the assignment, even though they thought it was important.
2. Most of students did not really know what should go in a cover letter, so they appreciated the "3 paragraphs, which are 'why you', 'why me' and 'why us'" guidance.
3. The assignment instructions that focus on a very specific job role was useful, as most students had not thought about this.
4. The output from ChatGPT was very good indeed, with one student saying "I would hire me based on this cover letter!"
5. The C.R.A.F.T. framework was a very useful tool to improve the output from ChatGPT. In particular, students liked the "cut the fluff" and "trust-build with a personal story and tone" part of the framework.

5. ISSUES TO CONSIDER

Generative AI platforms are changing constantly, including the amount of access they give. For example, when we first wrote the instructions for the creation of a digital avatar from text, the instructions were to use Midjourney. The popularity of Midjourney meant that its servers became overloaded between the time we wrote the assignment and the time students started the project, a period of less than two weeks. Students were now not able to use it for free to create an avatar.

This issue was reported by a student in our online forum dedicated to these generative AI assignments. The screenshot of the issue, as requested of students finding an issue, is shown in Figure 3.

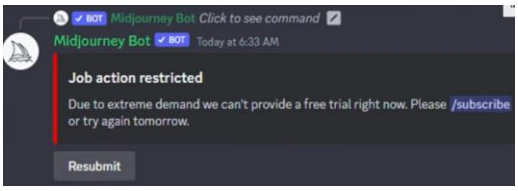


Figure 3 Midjourney error message

As a result, we told students to use Stable Diffusion (www.Stability.ai) instead. After a quick test ourselves, we posted instructions to use Stable Diffusion's "DreamStudio" platform. We also told students that in the DreamStudio platform they needed to select "photographic"

from one of the many options in order to generate their avatar.

Just two weeks later, after the students had finished their project, things have changed again. DreamStudio is still an option, but a new option, ClipDrop is now available which would work very well for this project (https://clipdrop.co/stable-diffusion). It is therefore important for any instructor using this case to work through the entire case themselves before assigning students to check the current availability of the relevant generative AI tools.

6. RESOLVING ISSUES

It would be easy to get dissuaded from doing these types of assignments with students due to the ever-changing instructions needed to support them.

We addressed this in several ways:

1. Be clear with students that generative AI technology is evolving rapidly. As such, instructions that worked yesterday, or even this morning, might not work this afternoon. Let students know that this is not an error. This is just how the generative AI space is. We have found that making students aware of rapid change makes them more accepting of rapid change.
2. Ask students to report issues immediately to the online forum and provide screenshots of what the problem is. The student who reported the issue with Midjourney provided the screenshot, Figure 7, that showed what the issue was. It became apparent pretty quickly that we needed to move away from Midjourney.
3. Ask students for suggestions for new platforms to use to complete the task. These should be emailed to the instructor, not posted in the online forum so that a vetting-and-testing process can be performed. This is an architecture of participation, and if students are aware upfront of their role in helping move the assignment along, we have found that they are very happy to provide suggestions. Figure 1, first image, shows that this student used the Artflow.ai platform instead of Stability.ai DreamStudio to complete their text-to-avatar part of the project. In order to not have students overwhelmed with options, we do think it useful and important for suggestions of new platforms to be submitted to the instructor via email, not in the online forum. For instance, we did not share the Artflow.ai platform with students as the Stability.ai platform was sufficient for the students to complete this project.
4. Ask students how they completed the assignment. We did this by asking students to specify how they utilized the C.R.A.F.T. framework. We could have also asked them to document what prompt they used for their text-to-avatar part of the project, or what "tuning" they used (tuning is what the settings were used in the generative AI tool, such as "photographic" mode in Stability Diffusion for the output), and also why they used these particular settings. Doing this makes the students more aware of the importance of "prompts" and why it is important to think about them.
5. Platforms are amalgamating functionality. Our assignment workflow for the text-to-video was to 1) Use Stability.ai DreamCloud for text-to-avatar creation, 2) use ChatGPT to create the *What is MIS?* narrative, 3) take that narrative into ElevenLab to create text-to-speech, and 4) take the speech output and the avatar into D-ID to create the video. Over the course of the 2 weeks of the assignment we noticed that D-ID started offering avatar creation, so it would have been possible to drop the Stability.ai DreamCloud part of the assignment. We don't think this is a good idea, and we did not let students know that D-ID offered this option. Given the enormous evolution in the generative AI space, we think that exposing students to as many generative AI platforms as possible is useful.

Finally, we want to address how to grade these assignments. First and foremost, the instructor must consider what they want to achieve with the assignment, and what their learning objectives are for their students. Our goal is to get students to use generative AI tools and think about the prompts they are writing to get what they are generating. There is no "right answer." Indeed, having given very specific instructions for the "What is MIS?" assignment, what we found was that generative AI produced a vast array of answers, proving that it is indeed "generative." One powerful way to grade these assignments is to ask students to reflect on what they have produced, and what they have learned in the process. We do that with the document they have to submit with their cover letter, described above. For the video, given our learning objective of getting students using the tool, developing prompts, and thinking about the outputs as a result of those prompts, we use the following basic rubric: "Developed a usable video and demonstrated an understanding of the use of generative AI technology", "Developed a

generative AI video that would not be able to be used as it [pick your issue] "did not address the question it was asked to address", "was not long enough", "was too long", "was not professional enough to be able to be shown publicly" (note: in our class we encourage creativity, so we do not grade for the type of avatar or voice used)", and finally "no submission."

7. CONCLUSION

"With how generative AI is evolving, it seems clear that my next hire is going to be a prompt engineer (J. Santucci, personal communication, April 3, 2023). Preparing our students to be a prompt engineer, someone who writes the prompts for the future of work in an AI-generated world, seems to be a very important educational goal. In this teaching case, we have presented two parts of a final project that allow students to use a range of generative AI platforms. The text-to-video assignment has students writing a range of prompts: 1) a prompt to build an avatar from text, and 2) a prompt to write a video narrative about What is MIS? The generative AI cover letter assignment has students writing a ChatGPT prompt, and then editing the output using a framework they have learned to improve the output from written generative AI. This is a critical skill for a "prompt engineer." These two assignments also allow students to use several generative AI platforms, which we think is critical for the future role of a prompt engineer.

The quantitative results and qualitative feedback we have received from students have been overwhelmingly positive. Comments include things that are not common with other assignments in the Introduction to MIS class, such as sharing a text-generated video with family and friends on the topic of What is MIS? Students have told us that the C.R.A.F.T. framework for working with the output of written generative AI is something that they will find useful going forward for a range of tasks.

From a teaching perspective, we allocate 6.25% of the grade to each of the two projects, for a total of 12.5%. We feel that the skillset of prompt engineering in a generative AI environment is relevant, timely, and important enough to allocate a solid amount of the student's grade to it. We have only a simple rubric for both these projects, partly as we need to see what the outputs are from this entirely new approach in order to figure out what a sensible rubric is. One element of the rubric should be the length of the video for the text-to-video project. Given the outputs of that project, we now also feel that a consideration of the match between the generated-voice and the generated-image should be part of the rubric. Going forward, we also feel that it might be appropriate to have students document the prompts they used in ChatGPT to generate the What is MIS? narrative, and the rubric can then take into account focused and useful prompt writing more specifically. For the ChatGPT-generated-cover-letter, the rubric should assess how the students use the C.R.A.F.T. framework, with points allocated to the quality of consideration and application of each element.

These projects complement the model curriculum objectives in IS 2020: IS Competency Organizational Domain, use and implications for society (Leidig & Salmela, 2021), and the Management Curriculum for a Digital Era (Lyytinen et al., 2021) components of AI and Automation.

One of our unwritten goals for our introduction to MIS class is to make our students dangerous with emerging technology. Dangerous means that we introduce them to the surface of the possibilities of the technology, hoping that they will be sucked below the surface by wanting to learn more. We certainly feel that the two assignments presented here in this case/instructor document achieved this.

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APPENDIX A

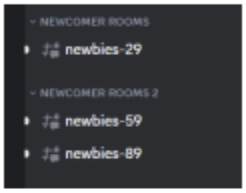
Describe what Management Information Systems is in a completely AI-generated video.

You will create a photo-realistic avatar from a text prompt, develop a script for your avatar using ChatGPT prompts, translate that text script into a voice using a voice generator, and then put it all together in an AI-generated video.

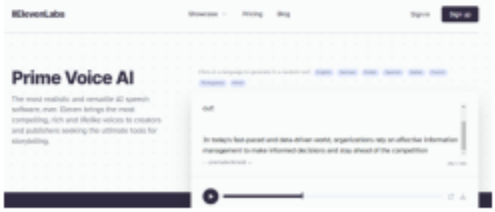
The purpose here is to show that you can create a complete, **reasonably realistic video from text alone, with the text itself generated by AI**.

CRITICAL: You must answer the question *"What is MIS?"* in your AI-generated video

1) Got to Midjourney.com and get yourself an account
2) Once logged in to Midjourney, go and click on one of the Newbie areas



3) Create an avatar by typing in a prompt that matches what you want Midjourney to create for you.
   Make sure you ask for "photo-realistic"
4) Go to Openai.org and get yourself an account
5) At chat.openai.org use ChatGPT to create a "**narrative script**" for what you want your AI-generated avatar to say in your video.
   This will take some effort, as the real key to ChatGPT is how you structure your prompts. It'll be very obvious whether you put effort into this part, or not, and this will affect your final grade.
   You can start with "Create a narrative script explaining what is MIS?" as a starting point if you've not used ChatGPT before.
6) Go to https://beta.elevenlabs.io/sign-up and sign up. This is "The most realistic and versatile AI speech software, ever" according to them. We will use this to turn the ChatGPT script into voice
   Once you have an account, you click on "Get started for free"
   Cut and paste the narrative script from ChatGPT into the Prime Voice AI box

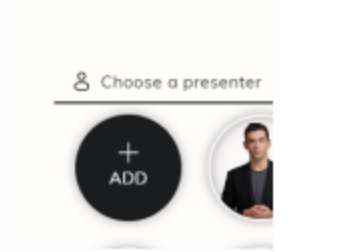


You might need to do a bit of editing from your ChatGPT text – I had to remove the words "narrator"

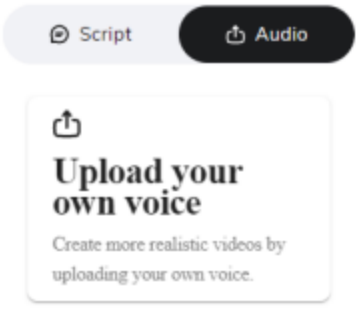
7) Go to https://www.d-id.com/ which will take your photo-realistic avatar and your AI-generated voice script and combine them to make a video.
Sign up for an account
Click on "Free Trial"

Click "Create Video"

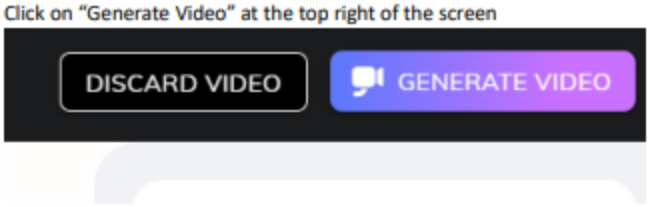
Click "Add" on Choose a presenter and upload your AI-generated avatar



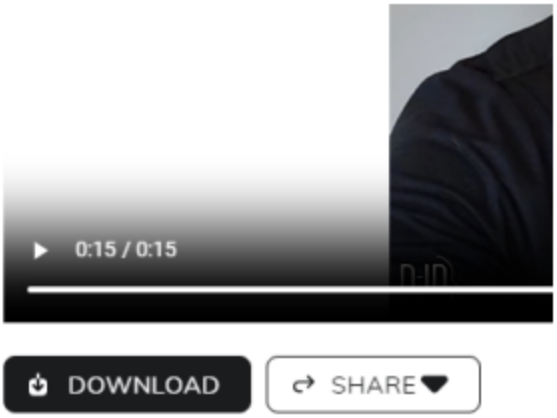
D-ID also has the option to create an avatar here now, which shows how tech firms will continue to add features to their software offerings to create consumer lock-in. Now a user doesn't need to go to Midjourney to create the avatar
Next, upload the voice version of the script we created in 11Eleven



Click on "Generate Video" at the top right of the screen



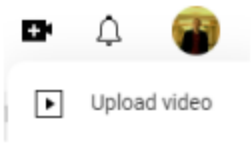
Get your video by clicking on the "Download" button



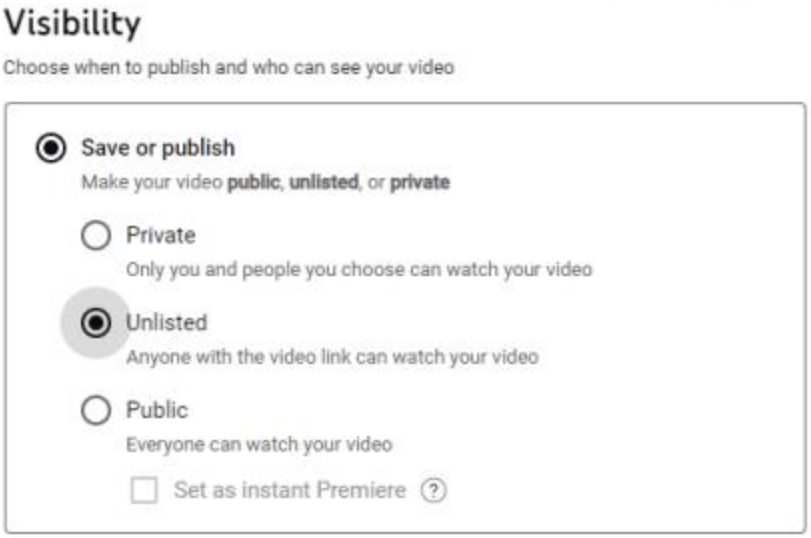
8) You now need to **upload your video to YouTube**, make it **unlisted,** and submit the **unlisted link** for grading. It is critical that your link is **unlisted.**

I have a video in Moodle on how to upload to YouTube, but you just need to go to YouTube.com and click on this button, which is top right. You do have to be signed in to do this.

Once you are there you click "Upload video"



The key here is to change the Visibility to "unlisted". If you get this incorrect and make it Public or Private you will get a zero grade if you don't change this to "unlisted" in a very timely fashion

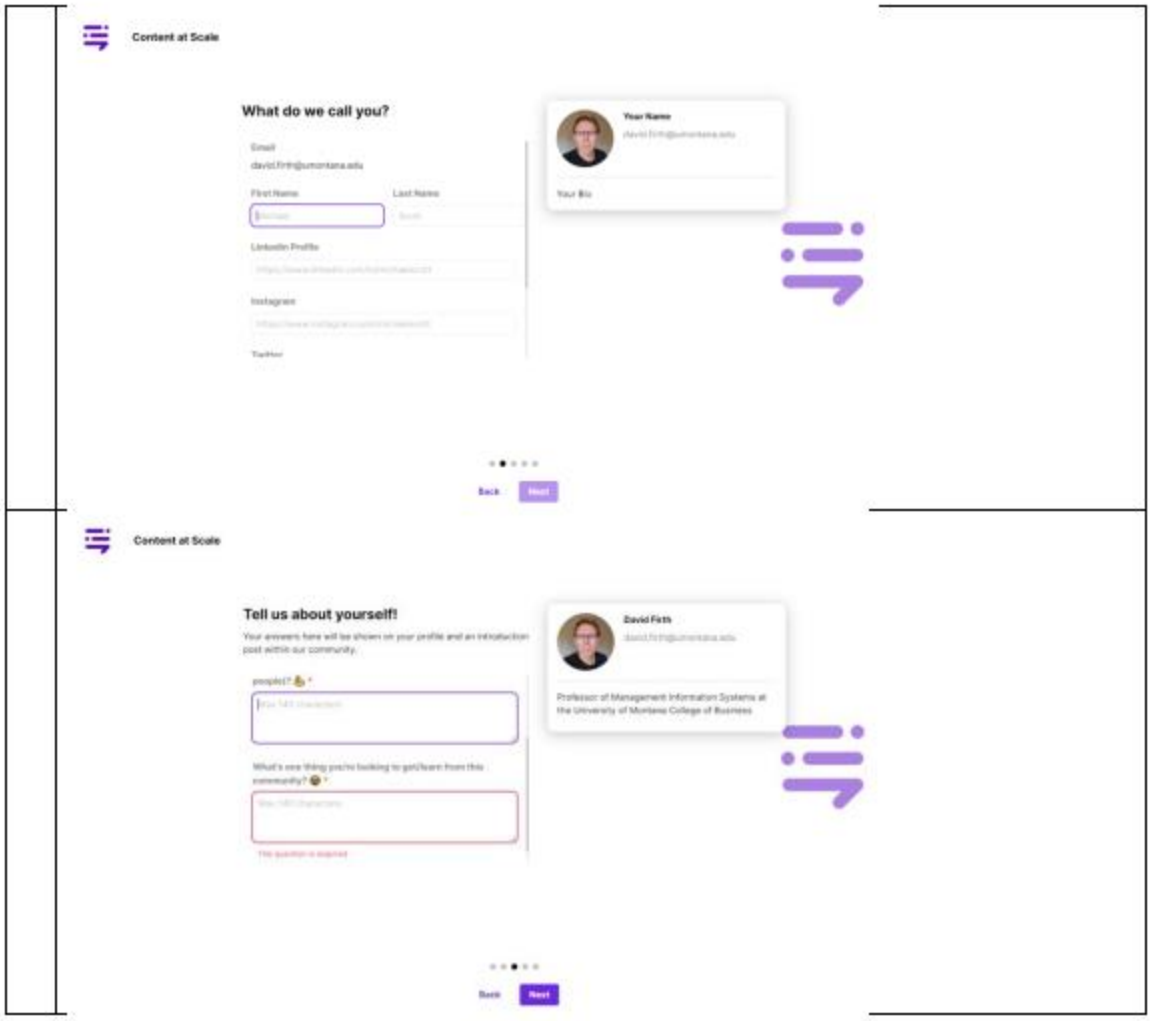


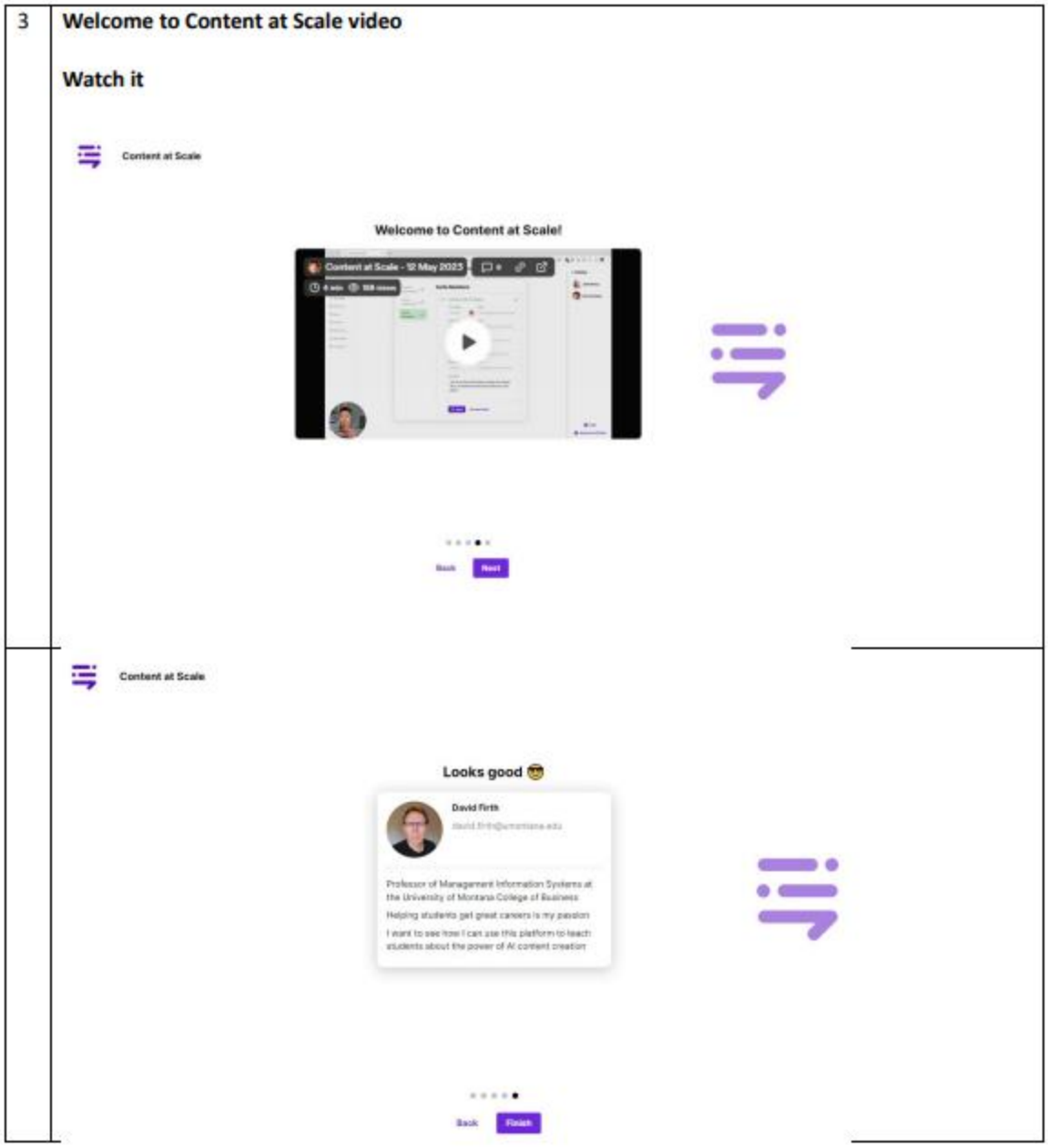
Get and submit YouTube shareable link to Moodle for grading

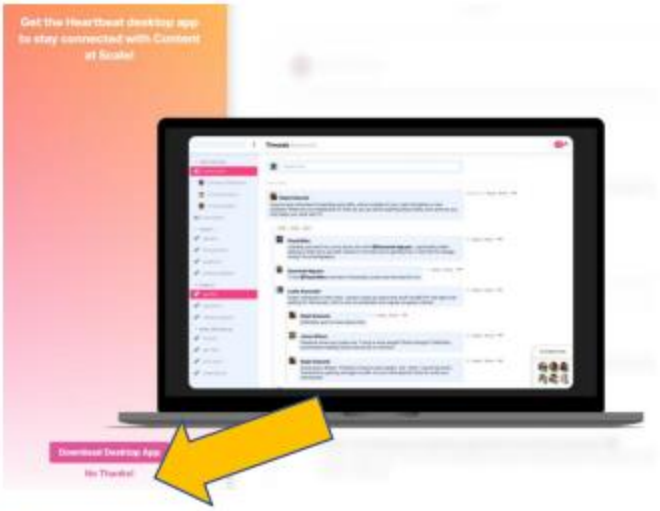
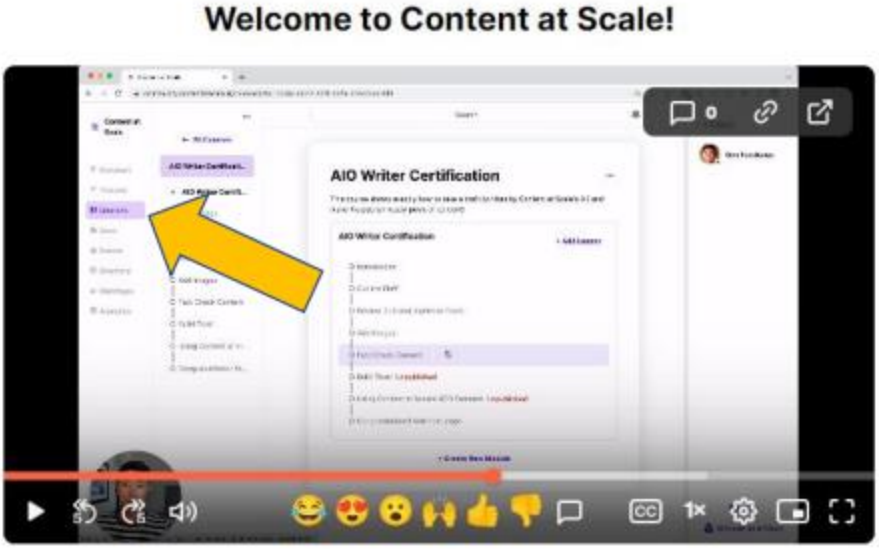
The very short video (too short for this assignment, as it was **just a test**) I created is here. I also used a photo not an avatar. You must create a photo-realistic avatar.
https://www.youtube.com/shorts/H5pL25SC9JM

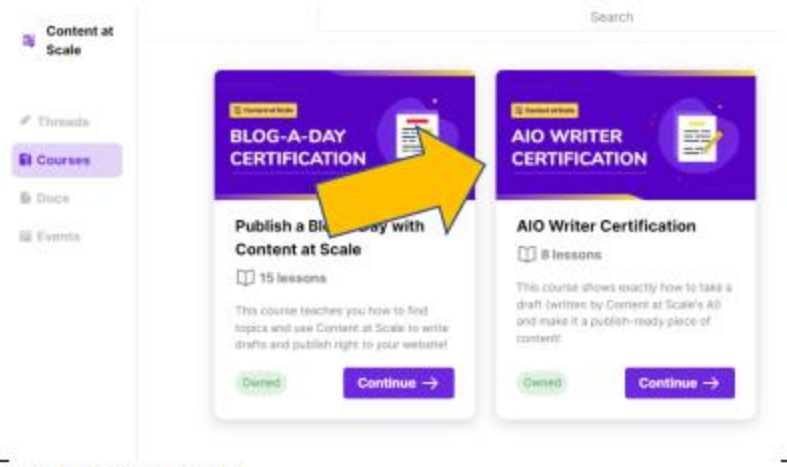
APPENDIX B

	Content at Scale
1	Go to this website: https://community.contentatscale.ai/courses  Create a new account by hitting the "Sign up" button
2	


Content at Scale
What do we call you?
Email
david.firth@umontana.edu
First Name
Last Name
LinkedIn Profile
Instagram
Twitter
Your Name
Your Bio
Back
Next
Content at Scale
Tell us about yourself!
Your answers here will be shown on your profile and an introduction post within our community.
David Firth
Professor of Management Information Systems at the University of Montana College of Business
Back
Next


3
Welcome to Content at Scale video
Watch it
Content at Scale
Welcome to Content at Scale!
Content at Scale - 12 May 2025
Back
Next
Content at Scale
Looks good
David Firth
Professor of Management Information Systems at the University of Montana College of Business
Helping students get great careers is my passion
I want to see how I can use this platform to teach students about the power of AI content creation
Back
Finish

	I hit “no thanks” when asked about the desktop app 
4	Click on “Courses” 

5	**Select AIO Writer Certification** 
6	**Complete the course** 
	The key here is this is that AIO provides a FRAMEWORK. Frameworks provide you a tool that you can work with to build something different each time using a repeatable process. You can also use a framework when you are faced with something new as it gives you a way to think about things.
7	Submit a **screenshot of the** the certificate including your name 

8	Use the AIO Writer to write a cover letter for yourself. In your assignment submission, you **must** talk about what order you did things in, and why, from the CRAFT framework
9	Your final assignment submission will be a Word document (or pdf) that contains **three things**: 1) Screenshot of your AIO Writer Certifcate with your name 2) Your *Content at Scale* AI-written cover letter 3) A description of how and in what order you used the *Content at Scale* AIO Writer CRAFT framework to achieve your AI-written cover letter

Examining Essential Factors on Student Performance and Satisfaction in Learning Business Analytics

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Abstract

With businesses increasingly prioritizing data-driven decision making, the demand for business analysts is high and expected to grow. In response, many universities and institutions have developed courses and programs related to business analytics to prepare more graduates for careers in this field. Business analytics programs and educators consistently strive to achieve a high level of student learning success, ensuring competence in working in the business analytics field after graduation. In this study, we aim to examine key factors influencing student learning in business analytics, focusing on performance expectancy and satisfaction. We examined specific factors, including personal interest, career relevance expectancy, learning effort, and perceived course structure effectiveness, from perspectives related to both students and instructors. A research model was developed and empirically tested. The results showed that all factors significantly influenced both perceived academic performance and learning satisfaction. Additionally, personal interest and career relevance expectancy could significantly impact learning effort.

Keywords: Business analytics, student learning, personal interest, career relevance, course structure, learning effort

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Examining Essential Factors on Student Performance and Satisfaction in Learning Business Analytics

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1. INTRODUCTION

The data world continues to evolve beyond big data with the addition of the internet of things and industrial internet of things (Amarnath, 2023). In addition, the internet now reaches 63% of world population (Domo, 2022). Organizations are facing increasing amounts of data from vendors, customers, and their internal operations.

This data is viewed by organizations as an asset, even labeled "the new oil" – a term coined by Clive Humby in 2006 (Amarnath, 2023). Extracting value from this data to support and inform decision-making is the role of business analytics. To extract useful information, this data must be analyzed to find patterns, make predictions, and garner insights. Organizations must have managers who can utilize the results to inform decisions.

Both the U.S. Bureau of Labor Statistics and some academic literature use the term *data science* as an umbrella term for fields and professional positions that "use analytics tools and techniques to extract meaningful insights from data" (U.S. Bureau of Labor Statistics, 2023) which includes business analytics, data analytics, and data science. Here, we use data science as an umbrella term and business analytics as the field where data is transformed using analytics tools and techniques to gain insight for business decision-making. Gartner Group is predicting a shortfall in data skills and literacy making it difficult for organizations to achieve their data-driven goals (Sallam & Goasduff, 2022). The job outlook for data scientists for 2021-2031 is a 36% increase which is expected due to increased demand for data-driven decisions (U.S. Bureau of Labor Statistics, 2023). Analytics is permeating other business majors, as evidenced by the inclusion of 'Human Resource Analytics Manager' in LinkedIn's list of the 25 fastest-growing job titles over the past 5 years (LinkedIn, 2023).

Academia has responded to this gap in data science talent by creating courses, certificates, and programs designed to train students of all levels and disciplines to use data to inform decisions. It has been suggested that all business students need to have some level of knowledge about business analytics and think as a data strategist (BizEd, 2019).

In addition to the challenge of insufficient talent supply, roles and skills needed to conduct data science are poorly understood and defined (Davenport, 2020; Fayyad & Hamutcu, 2021). Organizations have assumed that each hired data scientist would have all skills needed. However, this set of skills is broad and encompasses multiple fields – statistics, data engineering, analytics, and now artificial intelligence. Such a data scientist has been labeled a unicorn (Davenport, 2020; Fayyad & Hamutcu, 2021). What is needed instead is a team from a variety of specialties with complementary skills. Such a team, however, is also not well defined. Davenport (2020) described a large bank that studied the roles and skills of its data scientists, finding 100 teams of 2,000 employees. They identified seven job families with 65 roles in analytics and data science. Clearly, data science is an "umbrella term" (Fayyad & Hamutcu, 2021).

The novelty and breadth of the term "data science" and its associated job market demands make teaching business analytics classes quite challenging. With the ultimate goal of ensuring student learning success, a significant amount of research effort has been dedicated to the design and development of business analytics classes and programs (Anderson & Williams, 2019; Eckroth, 2018; Olson, 2018; Paul & MacDonald, 2020; Yap, 2020; Zadeh et al., 2021; Zhang et al., 2020). This includes a variety of courses ranging from less technical ones to programming-heavy ones, encompassing general education as well as domain-specific areas such as marketing business analytics and healthcare analytics. Overall, these research works have provided valuable insights into curriculum development, course content, and pedagogical approaches in business analytics education.

However, another possible way to contribute to the research field of business analytics education is to investigate factors that may influence student learning in this context. Unfortunately, in comparison to the aforementioned group of studies, significantly less effort has been devoted to empirically examining influencing factors on

student learning, particularly through the lens of nomological networks, which serve as theoretical frameworks for analyzing research constructs.

Recognizing this gap, the current study aims to make a meaningful contribution to the existing literature on business analytics education. The primary objective is to develop and evaluate a research model that focuses on investigating the impacts of influential factors on student learning in the field of business analytics. By doing this, the study seeks to provide a more balanced understanding of the interconnections among different variables and their collective influence on student learning success.

The remainder of this paper is organized as follows: Section 2 presents the related literature and develops a set of hypotheses. Following that, Sections 3 and 4 provide details on the research method and the results of the data analysis, respectively. Finally, the paper concludes with a discussion of the research contributions, implications, and future research directions in Section 5.

2. RELATED LITERATURE AND HYPOTHESIS DEVELOPMENT

In the field of business analytics education, a substantial body of literature exists on the creation of business analytics classes, including details on class designs and utilization of learning platforms (Eckroth, 2018; Olson, 2018; Yap, 2020; Zadeh et al., 2021; Zhang et al., 2020). Furthermore, significant effort has been dedicated to the development of business analytics-related programs (Clayton & Clopton, 2019; Molluzzo & Lawler, 2015), both at the undergraduate and graduate levels (Choi et al., 2017; Klašnja-Milićević et al., 2019; Paul & MacDonald, 2020). Some of these studies also incorporate an evaluation component with quantitative analysis based on students' ratings (Eckroth, 2018; Zadeh et al., 2021), while others focus solely on providing details regarding class and/or program design (Anderson & Williams, 2019; Clayton & Clopton, 2019; Jaggia et al., 2020; Liu & Levin, 2018).

For example, in a relatively recent study, Zhang et al. (2020) presented detailed information on the design of a business analytics course at two universities. The study included information on class topics, assignments, labs, and teaching tools. While the learning objectives, outcomes, and modules were consistent, there were slight variations in the labs and tools used at different universities. Furthermore, the researchers utilized the university's official teaching evaluation survey results to assess the course design.

In another study, Eckroth (2018) presented the design of a highly technical data analytics class that involved utilization of multiple programming languages and tools. The study included a thorough discussion of the course's learning objectives, topics, and schedules. Additionally, a set of six questions was employed to assess the effectiveness of the course design.

Regarding the literature on designing business analytics programs, Clayton and Clopton (2019) provided a comprehensive discussion of the redesign of the business curriculum, including the incorporation of the BA certificate program. In another study, Tremblay et al. (2017) presented the development of a program aimed at integrating business analytics across clinical and administrative disciplines. This program was a collaborative effort across colleges at Florida International University. In the study conducted by Liu and Levin (2018), the authors discussed a progressive approach to transforming the existing marketing program into one with a focus on analytics. Furthermore, Paul and MacDonald (2020) identified skill-based gaps between industry and academia. They proposed specific courses based on clustering by similarity those skills, industry requirements, and intangible student traits.

Compared to the aforementioned literature focused on course/program design, there has been relatively less effort dedicated to developing research models for examining and assessing student learning in the context of business analytics classes. Therefore, this study aims to contribute to this body of literature. We include three factors that are primarily controlled by either students themselves or instructors: students' personal interest in the business analytics subject, their expectations regarding the relevance of the topics covered in the class to their future career needs, and the course structure that is designed and provided to them by their instructors.

In the context of this study, personal interest is defined as students' intrinsic passion for acquiring knowledge in the field of business analytics. Previous research has emphasized the importance of personal interest in learning information systems (Li et al., 2014). Based on survey results from Li et al. (2014), IS majors tended to have a higher level of personal interest in this subject compared to general business

students. It is reasonable to believe that students with a higher level of personal interest in the subject of learning would generally be more dedicated to their learning.

Moreover, when investigating the impact of personal interest on learning effort in the domain of enterprise resource planning (ERP), Alshare et al. (2015) found that students' own attitudes toward ERP systems significantly influenced their level of effort in learning this subject. This suggests that students' level of interest in a particular subject directly affects their motivation and dedication to learning. Similarly, a recent study by Herpratiwi and Tohir (2022) examined the relationship between learning interest and learning motivation. The findings revealed that a high level of interest in learning positively influenced students' motivation to learn. Drawing from these findings, it can be inferred that if students have a higher level of interest in business analytics, they could be more likely to hold a positive attitude towards learning and be more motivated to learn the subject matter. Consequently, it is reasonable to assume that they would be more willing to put effort into learning business analytics. Therefore, we propose H1 as follows:

> H1: Students' personal interest has a positive impact on their effort in learning business analytics.

Based on the concept of career relevance stated by Alshare et al. (2015), we define students' expectancy on career relevance as their perception of the relevance of learning and understanding business analytics to their future careers. In the study conducted by Alshare et al. (2015) in the context of ERP system learning, it was found that career relevance significantly influenced students' performance expectations, such as an increase in productivity and effectiveness in completing learning tasks. These positive outcomes may be attributed to the fact that students who perceived the career relevance of the subject were more motivated to learn and invested greater effort in their studies.

Furthermore, a recent study by Soeprijanto et al. (2022) found that students who had a clear view of their future careers were more likely to achieve better learning outcomes. This may also be because those students were more motivated to learn and were willing to put more effort into learning.

Other research has found that possessing a positive attitude toward learning could lead to an increased performance expectancy (Islam, 2013). In another study, Nguyen et al. (2016) examined and identified that attitude played an important role in perceived learning performance. In line with these findings, we anticipate a positive relationship between general learning attitude and expected learning performance. Such a positive attitude may serve as a driver for students to learn the subject matter, thus naturally leading to a higher level of willingness for students to put effort into their learning. Therefore, a positive relationship between learning effort and perceived performance could be expected.

Applying these insights to our context, if students believe that learning business analytics is relevant to their future careers, it is reasonable to expect they could be more dedicated to learning and, as a result, put forth greater effort in studying the subject. Consequently, this may lead to higher expectations regarding their academic performance. Hence, we propose H2 and H3 as follows:

> H2: Students' expectancy regarding the relevance of the business analytics class to their future career has a positive impact on their effort in learning business analytics.
>
> H3: Students' learning effort has a positive impact on their perceived academic performance in business analytics.

When examining the impact of students' learning effort on their learning satisfaction, Bećirović et al. (2022) conducted a study and found that students who invested additional effort into learning not only achieved better class performance but also experienced significantly higher levels of satisfaction with their learning. This suggests that the more effort students put into their studies, the more satisfied they can be with their learning outcomes.

In a recent study by Shi et al. (2023), which involved a large-scale survey of 385 students, the authors examined the relationship between learning effort, learning intention, and learning satisfaction. They found that learning effort had a significant impact on learning intention, which, in turn, significantly influenced learning satisfaction. This study highlights the important role of learning effort in shaping students' intention to learn and their subsequent satisfaction with the learning process.

Based on these previous findings and considering our context, we hypothesize that learning effort

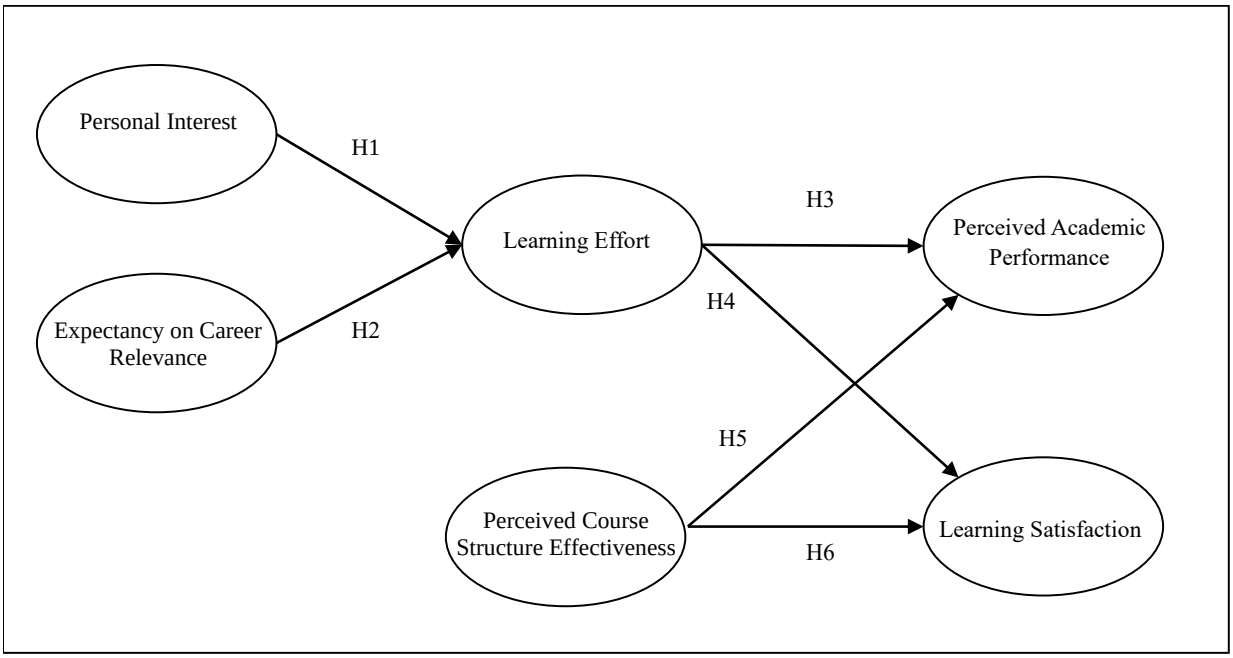

Figure 2 Research Model and Hypotheses

positively influences students' learning satisfaction in the field of business analytics education. Students who invest more effort into their studies are likely to experience higher levels of satisfaction with their learning outcomes. Therefore, we propose H4 as follows:

> H4: Students' learning effort has a positive impact on their satisfaction with learning business analytics.

Course structure is defined as the clarity and organization of the course topics and related materials (Alshare et al., 2015). Although Alshare et al. (2015) defined course structure in objective language, they assessed it based on students' perceptions on this construct. Thus, to make it clearer, we refer to it as "perceived course structure effectiveness" in this paper. Previous research has demonstrated the significant influence of course structure on students' performance. For instance, Alshare et al. (2015) conducted a study in the context of ERP system learning and found that the way the course was structured had a substantial impact on students' effort expectancy, which, in turn, significantly influenced their expectations regarding their performance outcomes, such as increased productivity and effectiveness in completing learning tasks. These findings suggest that a well-structured course can help positively shape students' performance expectations and motivate them to excel in their studies.

In a study by Wall and Knapp (2014) that explored the specific learning environment created by instructors, it was found that the organization of courses and adoption of effective teaching styles had a significant impact on students' learning outcomes. The way instructors structure their courses can influence students' engagement, comprehension, and retention of course material, ultimately affecting their overall learning experience.

More recently, Baber (2020) conducted a cross-country study with undergraduate students from both South Korea and India universities. The findings revealed that course structure had significant effects on both student learning outcomes and satisfaction. A well-designed and organized course structure was found to enhance students' understanding of the subject matter and foster a positive learning experience and outcome expectations, leading to higher levels of satisfaction.

In our context of business analytics education, we propose that course structure plays a crucial role in shaping students' perceptions of their academic performance and learning satisfaction. A clear and well-organized course structure is expected to provide students with a solid foundation for understanding and applying business analytics concepts, leading to higher perceived academic performance. Furthermore, an effectively structured course is likely to promote a positive learning environment, engage students, and

increase their satisfaction with the learning experience. Hence, we propose H5 and H6 as follows:

H5: The perceived course structure effectiveness of the business analytics class has a positive impact on students' perceived academic performance.

H6: The perceived course structure effectiveness of the business analytics class has a positive impact on students' learning satisfaction.

The proposed research model is summarized in Figure 1.

3. RESEARCH METHOD

To assess the proposed research model, a survey was conducted with students enrolled in a senior-level undergraduate business analytics course. All business majors can enroll in this course. Students who take the course are typically in their junior and senior years of study. This course focused on various techniques and algorithms related to data mining, with an emphasis on teaching students how to effectively utilize and apply them to analyze and interpret business data. The course covered major topics and algorithms such as linear regression, logistic regression, association analysis, k-nearest neighbors (k-NN), decision trees, artificial neural networks, and clustering. While this course is highly technical, it has been designed to be accessible to all business majors, accommodating students with diverse backgrounds. The class does not necessitate the use of programming languages; instead, it leverages RapidMiner (https://rapidminer.com/), a well-known and powerful tool that enables the execution of various data analyses without the need of programming.

Each week, the course is dedicated to a specific algorithm, and accompanied by comprehensive learning materials. To enhance students' understanding, lecture videos and hands-on demonstration videos were provided, allowing them to review and reinforce their knowledge throughout the semester. In addition, students were required to complete one or two hands-on lab projects each week, providing them with practical experience and an opportunity to apply what they learned.

To gauge their comprehension, students also had weekly quizzes based on the respective topics covered. All learning materials were organized and accessible through an online learning management system. Furthermore, weekly reminder emails were sent to all students at the beginning of each week, outlining the main topic to be covered and providing deadlines for all course activities. Table 1 summarizes the course design and structure.

Component	Design
Major topics/algorithms	• Linear regression • Logistic regression • Association analysis • K-nearest neighbors (k-NN) • Decision trees • Artificial neural networks • Clustering
Assignments	Weekly hands-on lab projects
Assessments	Weekly concept quizzes and two hands-on exams
Learning materials	Lecture slides, lecture videos and demonstration videos, and other reading materials

Table 1: Course Design and Structure

After obtaining IRB approval, a survey invitation was sent to all 167 students who were enrolled in the course during the study period, and 121 students completed the survey. The survey was conducted two weeks before the end of the semester, after covering all major topics, which we believed to be a good timing. We offered extra credit worth about 1.5% of the total class grade to those who completed the survey. The respondents consisted of 61 males and 60 females. The average age of the participants was approximately 21.5 years old.

To assess personal interest, we utilized the concepts of "match with interest" and "personal interest" as described in Li et al. (2014), based on which we developed a set of three specific measurement items for this construct.

For measuring expectancy on career relevance, we employed the measures of career relevance from Alshare et al. (2015), which were originally developed to assess student effort in learning ERP systems. We modified these items to align with the context of our study. Additionally, we introduced one additional item (CAREER4) to capture this construct.

The measures for perceived course structure effectiveness were adapted from Alshare et al. (2015). Items related to learning effort were

developed based on the description of this construct in Alshare et al. (2015). To assess perceived academic performance, we adapted items from Islam (2013). Similarly, items for measuring learning satisfaction were adapted from Mohammadi (2015).

All questionnaire items were rated on a 7-point Likert scale, ranging from 1 for "strongly disagree" to 7 for "strongly agree." For a comprehensive list of the measurement items, please refer to Appendix A.

Construct	Mean	Standard Deviation
Personal Interest	4.548	1.785
Expectancy on Career Relevance	5.858	1.123
Perceived Course Structure Effectiveness	6.140	1.013
Learning Effort	5.518	1.304
Perceived Academic Performance	5.932	1.106
Learning Satisfaction	5.813	1.266

Table 2: Descriptive Statistics

Table 2 provides a summary of the descriptive statistics for all constructs. In general, students expressed positive opinions about the course, with the perceived course structure effectiveness receiving particularly high ratings (mean rating of 6.140 out of 7). This was followed by perceived academic performance and expectancy on career relevance (mean ratings of 5.932 and 5.858).

4. DATA ANALYSIS RESULTS

To test the research model, we utilized SmartPLS 4.0 (Ringle et al., 2022), a widely used software package that is based on the least squares structural equation modeling (PLS-SEM) technique. The reliability and validity test results are presented in Tables 3 and 4, respectively.

As presented in Table 3, the Cronbach's alpha values for all constructs exceed the generally accepted threshold of 0.7 (Au et al., 2008; Chin, 1998; Hair et al., 1998). The item loadings are all above the recommended guideline of 0.7 (except for AP3, which is borderline), and they are all statistically significant. These results indicate reliability of the measurement items for their respective constructs.

Construct	Cronbach's Alpha	Item	Loading	T-Statistics	P-Value
Personal Interest	0.979	PERINT1	0.971	34.245	<0.0001
		PERINT2	0.964	33.645	<0.0001
		PERINT3	0.973	36.924	<0.0001
Expectancy on Career Relevance	0.944	CAREER1	0.944	12.661	<0.0001
		CAREER2	0.882	13.865	<0.0001
		CAREER3	0.866	12.129	<0.0001
		CAREER4	0.902	15.844	<0.0001
Perceived Course Structure Effectiveness	0.831	STRUCT1	0.760	10.804	<0.0001
		STRUCT2	0.839	12.756	<0.0001
		STRUCT3	0.765	10.327	<0.0001
Learning Effort	0.908	EFFORT1	0.896	22.679	<0.0001
		EFFORT2	0.800	15.105	<0.0001
		EFFORT3	0.929	25.211	<0.0001
Perceived Academic Performance	0.843	AP1	0.885	18.671	<0.0001
		AP2	0.723	9.799	<0.0001
		AP3	0.699	9.696	<0.0001
		AP4	0.729	10.986	<0.0001
Learning Satisfaction	0.921	SAT1	0.988	30.162	<0.0001
		SAT2	0.898	17.79	<0.0001
		SAT3	0.791	8.969	<0.0001

Table 3: Reliability Test Results

Furthermore, as shown in Table 4, the composite reliability values are all above 0.7, demonstrating good internal consistency (Au et al., 2008). The average variance extracted (AVE) values are all higher than the threshold of 0.5, which is equivalent to the guideline of the square root of AVE greater than 0.707, indicating convergent validity (Chin, 1998). Additionally, the square root of AVE for each construct is greater than its correlation values with other constructs, indicating high discriminant validity (Chin, 1998; Gefen & Straub, 2005).

Model testing results are presented in Figure 2. The analysis reveals a significant and positive impact of personal interest on students' effort in

Construct	Composite Reliability	AVE	CAREER	STRUCT	EFFORT	SAT	AP	PERINT
CAREER	0.945	0.808	**0.899**					
STRUCT	0.834	0.623	0.484	**0.789**				
EFFORT	0.913	0.768	0.514	0.359	**0.876**			
SAT	0.934	0.803	0.475	0.549	0.598	**0.896**		
AP	0.854	0.578	0.575	0.714	0.720	0.782	**0.760**	
PERINT	0.979	0.940	0.607	0.183	0.551	0.430	0.544	**0.970**

Note: Diagonal elements in bold case are the square root of average variance extracted (AVE). Off-diagonal elements are correlations across constructs.

Table 4: Internal Consistency and Validity Test Results

learning business analytics. The path coefficient of 0.374 (t=3.525, p<0.0001) indicates that students who possess a higher level of personal interest in the subject are more likely to invest greater effort in their learning endeavors. This finding aligns with H1, which suggests that students' personal interest influences their commitment to learning business analytics.

Furthermore, it demonstrates that students' expectancy on the relevance of the business analytics class to their future career also plays a significant role in shaping their learning effort. The path coefficient of 0.289 (t=2.455, p=0.015) provides empirical support for H2, indicating that students who perceive the course's relevance to their future career are more inclined to exert effort in mastering the subject matter.

Additionally, the analysis reveals that students' learning effort plays a crucial role in determining their perceived academic performance. The path coefficient of 0.542 (t=6.408, p<0.0001) provides robust evidence for H3, indicating that students who invest greater effort in learning business analytics tend to achieve higher levels of perceived academic performance. This finding suggests that the more effort students put into their studies, the more likely they are to perceive themselves as performing well academically in the context of business analytics.

Also, it demonstrates that students' learning effort significantly influences their learning satisfaction. The path coefficient of 0.463 (t=4.917, p<0.0001) supports H4, indicating that students who exert more effort in their learning experiences tend to experience higher levels of satisfaction. This finding suggests that students who dedicate themselves to mastering the concepts and techniques of business analytics are more likely to derive a sense of fulfillment and contentment.

Moreover, the findings demonstrate that perceived course structure effectiveness plays a crucial role in shaping students' perceived academic performance and learning satisfaction. The analysis reveals a significant and positive impact of perceived course structure effectiveness on both outcomes, providing substantial support for H5 and H6.

The path coefficient of 0.510 (t=6.133, p<0.0001) for H5 indicates that perceived course structure effectiveness has a strong influence on perceived academic performance in the context of business analytics. A well-structured course, characterized by clear and organized topics and materials, fosters an environment for effective learning. When students encounter a well-designed course structure, they are more likely to comprehend and engage with the content, leading to a higher perception of their academic performance.

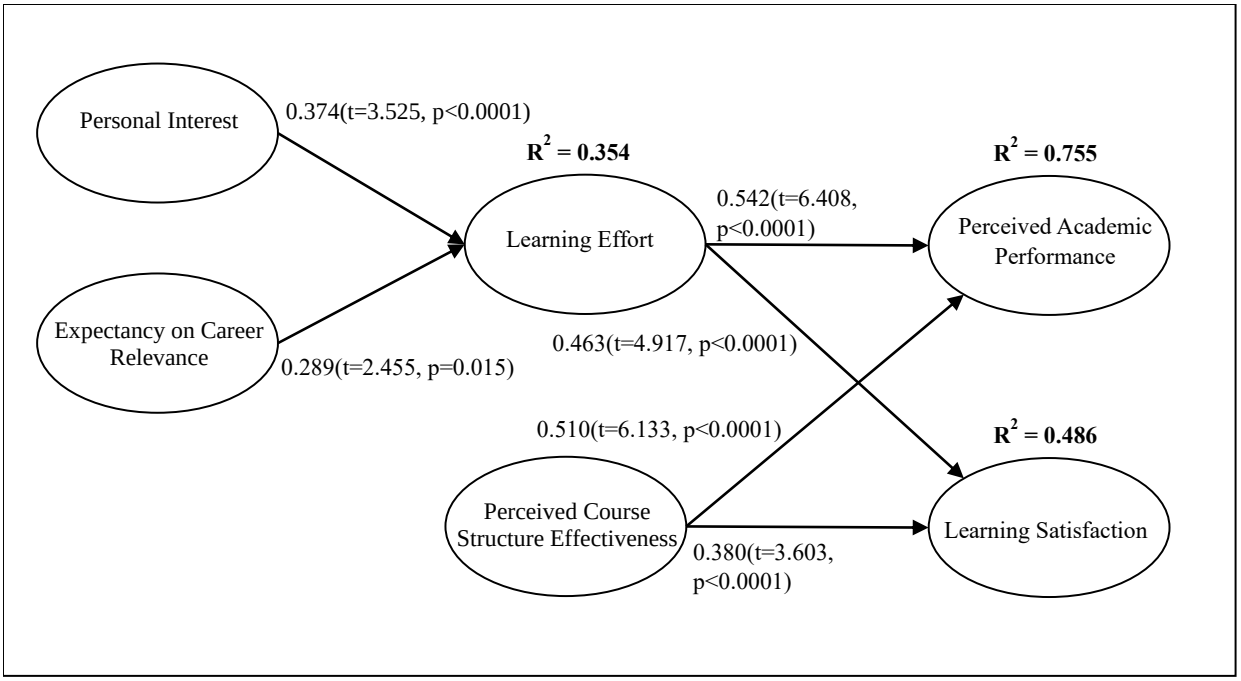

Figure 2 Research Model Test Results

The path coefficient of 0.380 (t=3.603, p<0.0001) for H6 highlights the positive impact of perceived course structure effectiveness on students' learning satisfaction. When students perceive that the course is well-constructed and supports their learning needs, they are more likely to experience higher levels of satisfaction. Clear instructions, well-structured learning materials, and effective organization of course components contribute to a positive learning experience, ultimately leading to increased satisfaction among students.

The R-squared value of 0.354 for learning effort suggests that the combination of personal interest and expectancy on career relevance accounted for 35.4% of the variance in students' learning effort. This indicates that these factors play a significant role in explaining students' motivation and dedication to learning business analytics.

Furthermore, the combined effects of learning effort and perceived course structure effectiveness accounted for 75.5% of the variance in perceived academic performance and 48.6% of the variance in learning satisfaction. These findings highlight the substantial impact that students' engagement and the organization of the course have on their perceived academic performance and overall satisfaction with the learning experience.

These results emphasize the importance of both individual factors (personal interest, expectancy on career relevance) and contextual factors (learning effort, perceived course structure effectiveness) in shaping students' academic outcomes and satisfaction in the context of business analytics education.

5. CONCLUSIONS

Research Contributions

In this study, our aim was to investigate factors that could influence student learning in the field of business analytics. The major contribution of this study lies in development of the research model that focuses on potential influential factors, namely personal interest, expectancy on career relevance, and perceived course structure effectiveness. Personal interest takes into consideration students' internal passion and intrinsic motivation for the subject of learning. It recognizes that students who have a genuine interest in business analytics are more likely to be motivated and engaged in their learning process. Expectancy on career relevance assesses the extent to which students perceive the alignment between business analytics and their future career needs. It highlights the importance of students recognizing the practical relevance and applicability of the subject matter to their desired career paths. Perceived course structure effectiveness measures the effectiveness of the instructor in organizing and presenting the learning content and materials to students. It acknowledges the role of well-structured and coherent instructional designs.

These factors, derived from different perspectives, cannot be solely determined by either students or instructors. By incorporating them into the proposed research model, we aim to provide a more balanced view of understanding student learning success in the field of business analytics. Furthermore, the research model includes two dependent variables: one focusing on measuring students' learning satisfaction, and the other assessing their performance expectations. By considering both, we can possibly gain a more comprehensive understanding of the impact of the identified factors on student learning experiences.

In addition to the model itself, the empirical testing results can also help solidify our understanding of student learning in business analytics by further validating the proposed relationships within the model. Specifically, the results indicate that all three factors, personal interest, expectancy on career relevance, and perceived course structure effectiveness, have significant and positive impacts on student learning in business analytics. Students who exhibit a higher level of personal interest in the subject are more likely to invest effort into learning it. Similarly, students who perceive a higher level of match between business analytics and their future career aspirations are more motivated to put in the necessary effort. Furthermore, students who exert more effort in their learning endeavors tend to experience higher levels of satisfaction and expect better performance outcomes. Additionally, the study highlights the importance of a well-designed course structure, as it positively influences both student satisfaction and performance expectations.

Furthermore, we adapted and developed measurement items for the constructs used in the business analytics context. Special attention was given to developing measures for personal interest, expectancy on career relevance, and learning effort. We hope that future research will find these measurement items helpful and utilize them in their studies.

Practical Implications

In summary, the study results provide valuable insights for educators in the field of business analytics. To ensure student learning success, educators must focus on specific key factors. Of utmost importance is the role of career relevance, serving as a lever for educators to enhance learning effort, ultimately leading to increased satisfaction and perceived academic achievement.

Compared with other well-established business majors and focuses, business analytics is still relatively new. In recent years, some universities in the US have developed specific programs and majors for it, while others may only now be starting to offer individual courses or certificates related to it. Additionally, there are universities where the discussion about implementing such programs has just begun. Due to this unique characteristic, aligning business analytics education with the job market and students' personal career development may be more challenging compared to traditional business majors. Therefore, clear communication and study plans that help students understand how various business analytics techniques and skills could benefit them in their future careers are of great importance. When teaching specific business analytics classes, educators must make it clear how class materials are relevant to different types of careers because, as found in this study, when students perceive the career relevance of course topics, it increases their learning effort, leading to greater learning satisfaction and perceived academic performance.

Along with the above discussions, faculty teaching business analytics should be intentional about including career relevance early and throughout their courses. It is also important to acknowledge that all students in business analytics classes are not necessarily headed for a business analytics career. That doesn't mean that business analytics will not be part of their career as a marketer or human resource manager. Providing information about how business analytics is involved in all parts of business is suggested and can be achieved via various ways such as inviting guest speakers (Alshare et al., 2015), using data sets on industry applications, and providing related readings such as Google's people analytics (Garvin, 2013).

Additionally, assisting students in formulating a clear career path plan is crucial. Educators can play a pivotal role in guiding students towards business analytics career paths. This can be achieved by providing comprehensive information about various job choices and opportunities related to business analytics. By offering up-to-date insights and industry trends, educators can equip students with necessary knowledge to make informed decisions about their future career endeavors.

Furthermore, educators should prioritize attracting students who possess a genuine interest in business analytics. To foster student interest, educators can highlight the significance of the subject matter and underscore its high demand in the current job market. By emphasizing practical relevance and potential career opportunities associated with business analytics, educators can help motivate students to potentially develop a true passion for the subject.

Finally, a well-designed course structure is critical for maximizing student learning outcomes. Educators should invest time and effort in developing instructional strategies and materials that are engaging, relevant, and aligned with the specific needs of business analytics education. By incorporating real-world examples, practical exercises, and hands-on projects, educators can enhance students' learning experiences and facilitate their mastery of business analytics concepts and skills.

Limitations and Future Research Directions

This study has several limitations that future research could further address, such as the limited set of factors, the use of one class for testing, and the lack of comparisons across students with different backgrounds.

First, future research could expand the current research model by incorporating additional factors from various perspectives. This will help enrich our understanding of student learning in business analytics. For instance, future studies could explore the influence of additional individual characteristics, such as cognitive abilities, motivation, or prior experience, on student learning outcomes.

Furthermore, while this study focused on a specific business analytics class, future research could extend the investigation to different types of business analytics courses. By examining a diverse range of courses, such as introductory-level or specialized courses, researchers can evaluate the generalizability of the proposed model across different educational contexts. Comparing the effects of the model in various course settings would provide insights into factors

that influence student learning across different levels and scopes of business analytics education.

Moreover, considering the potential differences between student backgrounds is another important avenue for future research. Investigating the variations in learning outcomes between business students and non-business majors would shed light on the unique challenges and opportunities faced by different student populations. Additionally, comparing undergraduate and graduate students would enable researchers to assess the impact of educational level on the relationship between influential factors and student learning in business analytics.

Another limitation of this study is that we didn't include open-ended questions in our survey to gather more specific information about student learning in the business analytics course. To address this, future research may consider using the interview method for more in-depth qualitative analysis, which could provide us with further insights into the factors influencing student learning in business analytics and the magnitude of their influential power.

In conclusion, this study contributes to the existing literature on business analytics education by developing a research model that encompasses influential factors such as personal interest, expectancy on career relevance, and perceived course structure effectiveness. The empirical results support the significant and positive impacts of these factors on student learning outcomes. While the study has certain limitations, it sets the stage for future research endeavors to further explore and enhance our understanding in business analytics education.

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Appendix A: Measurement Items

Personal Interest

PERINT1: I am genuinely interested in the subject of business analytics.
PERINT2: I have true interest the subject of business analytics.
PERINT3: I have personal interest in the subject of business analytics.

Expectancy on Career Relevance

CAREER1: Understanding business analytics (both concepts and techniques) will advance my future career.
CAREER2: Understanding business analytics (both concepts and techniques) could be important to my future career.
CAREER3: Understanding business analytics (both concepts and techniques) could be relevant to my future career.
CAREER4: Learning business analytics could better prepare me for my future career.

Perceived Course Structure Effectiveness

STRUCT1: The objectives and procedures of this class are clearly communicated.
STRUCT2: The class materials are organized into logical and understandable components.
STRUCT3: The expectations from this class are clearly stated.

Learning Effort

EFFORT1: I have put my best effort in learning business analytics.
EFFORT2: I have put the maximum effort possible in learning business analytics.
EFFORT3: I have put a significant amount of effort in learning business analytics.

Perceived Academic Performance

AP1: I can accomplish my learning tasks effectively in the business analytics class.
AP2: I can accomplish my learning tasks efficiently in the business analytics class.
AP3: I anticipate good grades in the business analytics class.
AP4: Overall, I am satisfied with my performance in the business analytics class.

Learning Satisfaction

SAT1: I am pleased with the business analytics class.
SAT2: I am satisfied with the business analytics class.
SAT3: The business analytics class satisfies my learning needs.

Teaching Case

A Data Analytics Module Introducing Principles of Social Enterprise and Humanistic Management

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Hook

Are you looking to equip your students with an understanding of both analytics and humanistic principles in decision-making? Shift your students' focus from solely profit-oriented perspectives to a more humanistic, ethical approach with our module on Humanistic Management and Analytics that blends humanism and data-driven decision making. By employing a hands-on approach, your students will enhance their ability to analyze, generate, and apply metrics that matter for human dignity as well as the bottom line.

Abstract

Ongoing seismic events in global society have increased demands on organizations to change their focus on profit maximization alone to becoming a social enterprise that follows humanistic management (serving the common good) principles. Coincidentally, business schools are under pressure to teach humanistic management principles in their curriculum to enable the future work force to become agents of world benefit. Data analytics offers a means to introduce these principles to undergraduate business students. The analytics module described in this paper introduces undergraduates in an introductory Information Systems course to humanistic management. It discusses the use of humanistic management analytics (HMA), and describes an assignment to design, develop and use a HMA dashboard. Through video, lecture, case study and assignments, students learn the value of incorporating humanistic management principles to analytics and human resource functions that embody concepts of data analytics for social good.

Keywords: Data Analytics, Humanistic Management, Human Dignity, Analytics for Social Good, Data Visualization, Experiential Learning

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A Data Analytics Module Introducing Principles of Social Enterprise and Humanistic Management

Thilini Ariyachandra

1. INTRODUCTION

Recent crises impacting society across the globe have created a crucial turning point to the view of companies as entities that should be solely driven by financial profit motivations. Global, national and regional cataclysmic events related to health, economy, politics and climate have begun to create serious shifts to organizations' management philosophies. Businesses are now forced to pay more attention to social concerns that go beyond financial performance and the quality of products and services. Various company stakeholders are asking for greater inclusivity, equality and sustainability. According to a Deloitte Insights report that surveyed 11,000 business leaders, in addition to financial metrics, organizations are also assessed based on their relationships with their workers, their customer and communities, as well as their impact on society at large – transforming organizations from business enterprises to social enterprises (Deloitte 2018).

The Deloitte report defines a social enterprise as an organization whose mission combines revenue growth and profit making with the need to respect and support its environment and stakeholder network. This includes listening to, investing in, and actively managing the trends that are shaping today's world. It is an organization that shoulders its responsibility to be a good citizen (both inside and outside the organization), serving as a role model for its peers and promoting a high degree of collaboration at every level of the organization (Deloitte 2018). In pursuit of the social enterprise, traditional management principles are shifting to a humanistic management approach. It is changing the perception of business less as a 'company' and more as an 'institution' that is integrated into the social fabric of society (Bersin 2018). While humanistic management is not new and was previously seen as a discretionary 'nice to do' trend in business, the urgency of its adoption has increased recently as the world has experienced various seismic societal events. For instance, a JP Morgan (2020) survey of global institutions indicated that respondents expect COVID-19 to increase awareness and investment in environmental, social and corporate governance investing in organizations.

Coincidently, business schools are being pressured to adopt humanistic management in their curricula to engender elements of social enterprise in the mindsets of the next generation of employees. For instance, the New Paradigm for Jesuit Business Education is calling for a reorientation of business education so as to address in a fundamental way the "growing challenges of the reigning economic order" such as climate and demographic changes, sociopolitical uncertainty, poverty alleviation, and global health improvement. Collectively, they affect the extant economic order and therefore call for a response. Given the central role of knowledge in understanding and solving these challenges, it seems important to prepare students in business schools to lead in the creation of a more inclusive and just world. A more inclusive and just world requires not only a humanistic approach but also integration of analytics in the management of business. This integration is feasible and essential in the era of big data, where the collection of data on justice and inclusivity allows for their consideration in management decision making processes.

The analytics module described in this paper is an attempt to integrate analytics and humanistic management principles in data driven decision making. We introduce principles of humanistic management to business students in the core introductory information systems (IS). The integration of humanistic management with analysis is an opportunity for instructors of IS to introduce to the concept of humanistic management to their students who are business majors and minors. In so doing, the instructors can help their students understand the importance of designing and using analytics from a humanistic management perspective. Our paper therefore makes a contribution in two ways. First this paper presents potential instructors with an introduction to humanistic management as well as why data analytics offers a vehicle to expose students to the humanistic approach. Second, it describes the resources and stages of the analytics module proposed to introduce analytics that is grounded in humanistic management.

2. LITERATURE REVIEW: HUMANISTIC MANAGEMENT

A review of the literature shows that humanistic management is a people-oriented approach to business conduct that seeks profits for human ends (Pirson, 2017). In that regard, it contrasts with other types of management that are essentially oriented toward profits, with people seen as mere resources to serve this goal. It involves consideration of the wholeness of the person, human dignity, shared value, transcendence, and stewardship (Kyle, 2020). These are based on the ethos for managing business: "the view of the individual and human work, the role of the individual in the society and in interacting with nature, the business firm, and the purpose of business in society" (Mele, 2016: 33). It is intended to resolve the ills that have arisen from the 'mechanistic' approach to business currently observed in the world today.
The call to humanize business derives from several sources including Pope Leo XIII in the late 19th century when he condemned situations in workshops and factories where employers laid unjust burdens upon their workmen or degraded them with conditions repugnant to their dignity as human beings. (George 1891); Catholic social teaching (see a compendium of the 20th century in PCJP 2004); the United Nations and other international organizations such as the International Labor Organization, and management scholars (e.g., Cunningham 1983; Meltzer and Wickert, 1976) have called for humanizing the workplace.

However, as prominent management scholars in the past such as Follett, Barnard and Drucker have indicated, the technical and human aspects of work are intricately intertwined. Follett (1941) noted that "we can never wholly separate the human and the mechanical problem" (p. 124), and Drucker indicated that it is important to focus on the wholeness of the person – along with power, values, structure, and responsibilities (Maciariello and Linkletter 2011; Drucker and Maciariello 2014). These observations suggest an analysis of the technical and human aspects of work.

3. HUMANISTIC MANAGEMENT ANALYTICS

We call the process of combining the technical and human aspects of work through data analysis humanistic management analytics (HMA). It involves the use of analytic tools, techniques, and processes for evaluating, deciding, and implementing programs that facilitate the integration of the human and technical elements. It can be applied to sustainability education (i.e., such as the analysis of sustainability challenges and best practices), analysis of risk of sociopolitical uncertainty (i.e., by leveraging data analysis techniques to understand and mitigate potential risks) as well as analysis of poverty and health (e.g., examining various socioeconomic factors and health indicators to reveal correlations and insights that can inform policies and interventions) to facilitate and orient attitudes and behaviors of students. In business education, HMA involves using analytics to highlight the use of humanistic data and decision-making practices in business. HR analytics, which requires integration of business analytics and human resources data, can serve as a good illustration of HMA and highlight the importance and use of humanistic management principles in business. The field of analytics in general and HR analytics in particular, are areas that are experiencing sustained demand and growth in industry. As a result, the information systems area in a business school that typically houses analytics curriculum can be the feeding ground to expose students to humanistic management and social enterprise.

Data Analytics

The 21st century has brought a wave of innovation and economic activity centered on data (Einav and Levin 2014) known by various terminologies such as data analytics, data science, big data, and business intelligence. Gartner Research points out that advanced analytics and data science are becoming mainstream competencies in most organizations and that companies must seek to acquire talent and adapt their business models to keep pace with the competition (Laney and Jain 2017). Faced with these predictions and their own experience, companies increasingly view data analytics and associated fields as key to their future competitive strategy and their ultimate goal of profit maximization.

However, the supply of potential employees able to fill these roles is far below the demand (LinkedIn, 2018). According to IBM, 2,720,000 openings will be generated in the year 2020 in analytics (Markow, Braganza, Taska, Miller, and Hughes 2017). The US Bureau of Labor Statistics expects 11.5 million jobs to be created by 2026. Colleges and universities have responded by increasing data science and data analytics programs of study, but the number of students graduating from these programs is small in comparison to industry demand. In addition, their primary focus is on turning out graduates with the required technical and communications skills

(Lyytinen, Topi & Tang 2020) to manipulate data in innovative ways that create more market share and profits.

Demand for roles requiring knowledge and skills in analytics are increasing across the various functional areas in business. There is a need to attract more students who can combine data skills with their domain-specific skills to support decision making in different business functions such as human resources. According to a skills report by myHR future, analytics was the most demanded skill that HR professionals planned to learn in 2019 (Bailie, Ferrar and Green 2019). The human resources area is one functional area that is embracing analytics. Research by the Corporate Research Forum found that 69% of organizations with at least 10,000 employees have an entire team devoted to HR analytics activities (Schimdt & Green 2019). The demand for and success of HR analytics in organizations stems from the assumption that a company that has access to the right data and right analytical tools can create an unbiased view of the world that can lead to predicting human behavior (Angrave, Charlwood, Kirkpatrick, Lawrence, and Stuart 2016). This view inherently has challenges in reality. It also questions the view that organizations have access to rational, unbiased analytical decision making to attain profit maximization.

In decision making, users need an understanding of facts for assessment (Etlinger 2014). They need critical thinking that considers humanistic contextual elements along with factual data (Etlinger 2016) to create actionable insights. The ability to use unbiased data analytics tools (Naude 2020) such as dashboards that minimize application developers' own perceptions and biases are currently not the norm in the industry. Higher education is aware of these challenges and indicates the inclusion of "ethics, use and implications for society" as a core competency in IS programs to combat these issues (Topi, Karsten, Brown, Carvalho, Donnellan, Shen, Tan, & Thouin 2017). An AACSB Interim IS Report of Management Curriculum for the Digital Era states that "given the complexity of ethical issues raised by both analytics and AI, it is essential that graduates have effective models and frameworks to analyze the implications and potential ethical and moral consequences of emerging technologies (pg. 4)" (Lyytinen, Topi & Tang 2020).

The central theme of business education today is economic activity carried out by a company during the course of business with the primary purpose of making a profit. Principles of humanistic management stresses the importance of economic activity not solely focused on profit but to serve the common good. Humanistic management analytics provides as opportunity to look beyond the generic financial metrics utilized for data driven decision making in organizations to consider other humanistic contextual factors that can influence an organizations strategies and actions. Integrating humanistic principles to an analytics module offers students the ability to learn these principles while gaining analytics skills and knowledge.

4. MODULE ON HUMANISTIC MANAGEMENT ANALYTICS

The module proposed on humanistic management analytics aims to introduce the concepts of humanistic management (HM) and humanistic management analytics (HMA) followed by enabling students to gain hands-on experience with HMA examples. Through an experiential learning experience that develops students' analytics skills in the human resources area, they are given an opportunity to reflect between the current profit seeking perspective (i.e., homo economicus) and humanistic ethical perspective of analytics (homo ethicus). The goal of our proposal is twofold. First, we seek to awaken students to the underlying ethical challenges in using traditional HR analytics for data driven decision making and business profitability as we expose them to how dashboards are used in industry. Second, we teach students on the integration of ethics with analytics to gain a more holistic approach to data driven decision making that support human flourishing and a humanistic view organizational success.

We developed and administered the module to students taking the introductory information systems course in a college of business in the Midwest region of the USA. The four main activities of the module, its purpose and outcome are described in Table 1. Each of the activities presented in the table and the needed resources are described next.

Introduction to HM and HMA

There is a growing body of educational resources in humanistic management currently curated by several centers of excellence in HM (e.g., Fordham University Center for Humanistic Management). Using existing resources, the two short videos below offer a concise introduction to HM. The content in the two videos describe how humanistic management operates on the central

principle of placing human welfare and ethics at the forefront of business practices and organizational strategies. In a world dealing with extreme wealth inequality, HM emphasizes the equitable distribution of resources in order to reduce economic disparity and to eliminate ideological terrorism rooted in deep-seated injustices and inequities. In addition, HM advocates for sustainable and eco-friendly business practices given the climate change and widespread environmental damage done by years of negligent practices. The two videos on HM:
https://www.youtube.com/watch?v=G45TfEj7p8g
https://www.youtube.com/watch?v=ZFVbqsWoKOg

Once students have an understanding of HM, they are introduced to HMA through a short discussion. The slides developed to introduce HMA (i.e., handout version) and its importance can be found in Appendix A.

Following the introduction to HMA, students are given a Tableau HMA dashboard to review and interact to answer questions that pertain to human resources. Using an existing HR analytics dashboard from Tableau Public (i.e., a free software package that allows users to create interactive data visualizations for the web) that has HMA metrics, students are given questions to answer by interacting with the dashboard. Metrics on employee wellbeing, engagement, inclusion, and performance are presented in the dashboard which enables students to see the use of analytics for HM. The assignment used for this task is presented in Appendix B.

Give students an HMA scenario and data set
Armed with experience and knowledge on HMA, students are next given an assignment that reviews a business scenario that needs the development of a HMA dashboard (See Appendix C). The case study (McCain 2009) was adopted from the Society for Human Resource Management, a non-profit professional organization that is dedicated to the advancement of human resources management professionals (https://www.shrm.org). The data set for the business scenario enhanced with HM data that corresponds to the business scenario was developed for this activity. A sample of the data set is also provided in Appendix C. Upon appraising the business scenario presented in the case study, they are asked to identify the metrics and user requirements to design a HMA dashboard.

Development of a HMA dashboard
Students first become familiar with the basic functionality of a data visualization to develop a dashboard through this step. Next, they build a basic HMA dashboard for the business scenario described in the previous activity.

#	Activity	Tasks	Purpose	Outcome
1	Introduction of HM and HMA	(a) Describe HM and HMA to students (b) Give students a HMA dashboard to answer questions.	To expose students to triggers of HMA decisions using hands-on experience of metrics and key performance indicators	Ability to critically analyze situations necessitating HMA
2	Give students an HMA scenario and data set	Require students to identify metrics of importance that correspond to the scenario	To have students learn to generate HMA questions	Ability to generate metrics that would help with decision making questions
3	Development of a HMA dashboard	Require students to design and develop and HMA dashboard	To have students generate instruments that help address HMA problems	Ability to solve problems
4	Dashboard Usage	Require students to use dashboards to make decisions that improve the HMA function	To instill in students the value of collaboration between HMA agencies.	The ability to collaborate effectively to resolve a major issue

Table 1: The Main Activities in the Module

While there are many data visualization tools in the market, Tableau offers a great introductory video tutorial along with data as well as a 14-day trial access to their software. We proposed the use of Tableau to gain basic dashboard building capabilities. The assignment to gain basic skills in Tableau can be found in Appendix D.

Once students have acquired a basic knowledge in dashboard design by working on the Tableau tutorial, next, they are asked to develop a HMA dashboard for Motors and More Inc. based on the metrics and requirements that they previously identified. The details of this assignment are also provided in Appendix D.

Dashboard Usage

Once students develop a HMA dashboard for the final activity, they manipulate and use the dashboard to meet the needs of Motors and More Inc. They also synthesize results and reflect on the value of creating HMA dashboards for data driven decision making. The assignment designed for this activity is in Appendix E.

The feedback from students after this short experimental module suggested that they enjoyed the experience and gained an appreciation for the concepts introduced. Student comments indicated that they enjoyed the interactive hands-on tasks the most. One student commented as follows in the open-ended feedback request from students, "I really appreciated the HMA dashboard assignment. It was a good example of a real HR problem solved by the IT department. In my internship, this is exactly the kind of interaction you will have at a real company. It is very beneficial for students." Another student stated, "Overall, I enjoyed this project and thought it was very beneficial, because it gave a real-world feel on how two different areas in a business interact with one another." A word cloud of the open-ended student feedback responses highlighted words such as 'helpful,' 'useful,' and 'interesting.' Given this initial success, we hope to continue developing more material with hands-on activities that integrate HMA with analytics.

5. CONCLUSION

The need for principles of social enterprise in business operations is growing in industry. The humanistic management approach can be adopted in organizations to move beyond mere profit maximization to incorporate benefits to society. Humanistic management analytics looks beyond traditional metrics to other measures that can help organizations make decisions that espouse social values. Higher education needs to better incorporate principles of social enterprise, HM and HMA in order to expose the next generation workforce to the evolving view of the organization.

The module described in this paper offers a means of introducing humanistic management principles to undergraduate business students while they gain skills in analytics and data visualization. In their anecdotal evaluation of the module, the students indicated that they had not only enjoyed the tasks in the module but also learned a lot about how HMA and IS can be integrated to generate meaningful output. Through the adoption of the resources in this module, and replicating the incorporation of HMA with analytics, instructors can give future employees a view of business that goes beyond the simple profit maximization outlook.

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APPENDIX A
Slides on Humanistic Management Analytics

OUTLINE

1. What is HMA?
2. What are the characteristics of HMA?
3. What are the dimensions of HMA?
4. What are the components of HMA?
5. What are the applications of HMA

Humanistic Management Analytics

(1) What is HMA?

- **Definition**
  - The process of evaluating humanistic management through the data analytic techniques.
- It combines the technical and human aspects of work.

Humanistic Management Analytics

(2) What are the characteristics of HMA?

- The use of:
  - Analytic tools,
  - Techniques, and
  - Processes
- Program
  - Evaluating,
  - Decision-making
  - Implementation
- Integration of the human and technical elements.

Humanistic Management Analytics

(3) What are the dimensions of HMA?

- Resources (human)
  - Human and environmental dignity and wellbeing
- Data (Analytics)
  - Subjective
    - Survey or self-report data on employee engagement in organizational activities – technical, social, natural
  - Objective
    - Measured effect of organizations' technical, social, and natural environmental activities.
      - Technical – technological activities
      - Social – human activities
      - Natural – sustainability activities

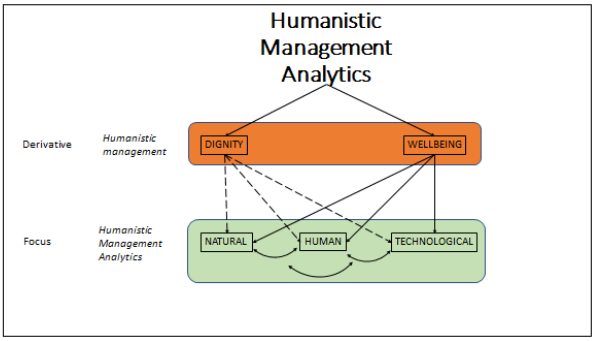
(4) What are the components of HMA?

(A) Humanistic management	(B) Humanistic Management Analytics
A. Dignity	1. Human (Resources)
B. Wellbeing	2. Technical (Data)

Humanistic Management Analytics

(5) What are applications of HMA?

- **Sustainability education,**
- **Analysis of risk of sociopolitical uncertainty,**
- **Analysis of poverty and health**



APPENDIX B
HMA Dashboard Application

Now that you have an understanding of humanistic management analytics (HMA), lets review a dashboard that displays HMA. Specifically review metrics on well being, engagement, inclusion and performance.

https://public.tableau.com/app/profile/charlotte.murray/viz/test_16130388902760/Overview

Once you review the dashboard and become familiar with the metrics as well as functionality offered by the dashboard, answer the following questions *(Provide screen shots from the dashboard that led you to your answers):*

1. List the top 3 departments in which employees express a greater well being

2. Indicate which department has the highest engagement

3. Identify the department that has the highest performance in terms of skills, work quality, leadership and communication

4. Indicate the top three departments that are dealing with gender pay gap.

5. Examine how departments compare in terms of performance scores, inclusion, engagement and wellbeing. Identify two overall insights you can gain from this analysis.

APPENDIX C
HMA Case Analysis

The case description used to given to students can be found at - https://www.shrm.org/content/dam/en/shrm/credentials/shrm-certification/teaching-resources/motors-and-more-inc-a-progressive-hr-case-study-instructors-manual.pdf

The case describes how Motors and More makes decisions to improve its human resources. Specifically, Motors and More, Inc. Motors and More, is a business-to-business sales company, manufactures small motors and accessories for industrial and home products. The industry is highly competitive, and the company follows a prospector strategy. Page 4 of the case document from the above link gives the initial background that should be given to students along with an organizational chart (Figure 1).

Next, review the data set related to case scenario (please find the first five rows of the dataset which has a total of approximately 10,000 rows of data. The full data set file is included as an attachment to this manuscript.

Date	Machine	Major Code	Manufacturing unit	Name	Workgroup	Work Description	Hrs Worked	Labour Productivity	Labour Productivity Alert	Machine Hours	Process Efficiency	Dignity	Esteem	Satisfaction
3/14/2016	ADDI-900	GML66M	CORK	Gerald Norqu	Alpha	Additive Processes	6	3.18%		0.203389831	93.85%	0.11	0.59	0.68
3/14/2016	ADDI-983	GML66M	CORK	Gerald Norqu	Alpha	Additive Processes	6	94.84%		24	23.71%	0.11	0.69	0.29
3/14/2016	ADDI-900	USS8F5	CORK	Michael Tuck	Alpha	Additive Processes	12	1.61%	RED	0.203389831	95.01%	0.13	0.2	0.59
3/14/2016	CAST-800	RITBNN	CORK	Teresa Wilco	Alpha	Casting C	4	95.64%		4	95.64%	0.06	0.53	0.32
3/14/2016	JOIN-110	RITBNN	CORK	Norma Newm	Alpha	Joining	3	96.63%		6	48.31%	0.13	0.25	0.36

Now that you have seen the role of data in decision-making for improving employee's welfare earlier in this module, a dashboard must be designed that will enable a manager make decisions on (a) dignity, (b) esteem, and (c) satisfaction. Create questions (i.e., requirements for the dashboard) that you can use to develop a dashboard to meet the decision-making needs of Motors and More. Create at least 5 questions. Here are some sample questions you could create:

Here are some questions that can be used to develop a dashboard to meet the decision-making needs of Motors and More:
1. What is the average score for dignity, esteem, and satisfaction across all employees?
2. How does the score for dignity, esteem, and satisfaction vary by workgroup, manufacturing unit, and major code?
3. What is the correlation between labor productivity and dignity, esteem, and satisfaction?
4. How does the score for dignity, esteem, and satisfaction change over time?
5. What is the relationship between machine hours and dignity, esteem, and satisfaction?

APPENDIX D
Introduction to Tableau & HMA Dashboard Development

Let's get hands-on experience with a BI and Analytics tool! We will be using Tableau Desktop to gain analytics experience. Tableau is a recognized leader in data visualization and has a wide variety of customers from smaller organizations to fortune 500 companies. For a company profile, the Website for Tableau is http://www.tableausoftware.com/

Tableau Tool Access:
From the main page – Tableau.com – click on button for "Try Tableau for Free". Register for the 14 day trial and download Tableau.
Tableau Tool Training:
Tableau works with spreadsheets among other things. Go to https://www.tableau.com/learn/training/20211. Under Free Training Videos, watch the 9 videos Titled "Getting Started". This will take a total of 20 minutes. Through these video tutorials that requires you to work along with the tutorial on Tableau, you will gain a basic understanding of how to build a dashboard.

Assignment: HMA Dashboard Development

Now that you have reviewed the HMA case scenario and the dashboard development requirements, using Tableau, build a dashboard that provide the metrics and the needs outlined in the dashboard requirements you previously identified. The dashboard should be built in a way to provide you with visualizations that would enable you to answer questions relevant to the objectives of Motors and More Inc.

APPENDIX E
HMA Dashboard Insights

Now that you have reviewed the HMA dashboard, in light of the case scenario, analyze the data presented in the dashboard you developed. Use the dashboard to get answers to the questions that you initially created for the development of the dashboard.
Next, lets focus on questions related to humanistic management. Specifically, there are questions about dignity, esteem, and satisfaction.
B.1) What does the data reveal about these three criteria?
B.2) As a manager responsible for your employees' wellbeing, what is the relationship between rewards and:

i) Employee dignity?
ii) Employee satisfaction?
iii) Employee esteem?

B.3) What measures can you put in place to measure and encourage and consequently improve employee dignity?
B.4) Does the data gathered suggest processes you could establish that positively affect employee satisfaction and esteem?

WWC: Leveraging Extreme Events in Teaching

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Abstract

2022 opened with World War C, the first major cyber world war. Wanting to capitalize on history in the making, Information Systems faculty are integrating real time events to increase student engagement, comprehension, and application of IS concepts. This paper outlines a successful midterm evaluation pivot that leverages current events. We discuss two different actions taken and objectives, outcomes, and implications for teaching and educational research. We find that incorporating extreme current events motivates students towards self-learning and creative knowledge outlets, which in turn stimulate greater comprehension, application, and retention across the entire class.

Keywords: pedagogy, teaching extreme events, MIS teaching and learning, Ukraine war in teaching

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WWC: Leveraging Extreme Events in Teaching

Jordana George and Parisa Aasi

1. INTRODUCTION

2022 opened with World War C (WWC), the first major cyber world war. Ostensibly between Russia and Ukraine, it has drawn in both physical and cyber combatants from across the globe. These participants include corporations such as Microsoft and Tesla, hacktivists such as Anonymous, and international volunteer soldiers fighting in person and online (Burgess, 2022; Chirinos, 2022; FightForUA.org, 2022; Gordon, 2022; Pitofsky, 2022; B. Smith, 2022).

The unprecedented spectacle of a war mediated through computer technology has presented IS educators with a treasure trove of compelling real-life examples in systems design and implementation, AI, cybersecurity, internet and systems access, autonomous vehicles, and fake news among others. The first war to be so completely fought on social media has also enabled some of the highest levels of transparency and lowest levels of information asymmetry ever seen in armed conflicts. One can only imagine what a WWII general would think about the ability to monitor troop movements in real-time on a webpage or watch guerillas tossing Molotov cocktails at tanks.

This new visibility not only keeps the public's attention level high but provides myriad examples for a range of IS classes and topics.

Today, it is critical to understand the information systems aspects of a war that has been continuing for over 600 days. Cyber security, responsibilities of different IS involved parties and social media can be topics worth of study in this case (Willett, 2022).

There are many different and novel ways of making students familiar with cases of current events that can be relevant to their course topics such as using metaverse and AI platforms (Baidoo-Anu & Owusu Ansah, 2023; Hirsh-Pasek et al., 2022). Innovation in running classes in MIS is a key to make classes updated and teach the students to be able to use their knowledge in the new world dealing with new challenges every day (Numonjonov, 2020)

Vivid social media-shared videos of civilians driving tanks or making homemade napalm or singing "Let it Go" in a bomb shelter have made the war relevant, personal, and accessible to any student with a smartphone or computer. The authors decided to capitalize on this phenomenon to engage students and provide deeper understanding in their IS coursework.

Two classes were selected to implement the course plan pivot. First, an undergraduate Management of Information Systems class was targeted for a revised midterm evaluation. This course was a mandatory upper division class for MIS majors and covers general MIS topics. The second course was a master's level elective course on Managing the Technology Organization and the revised assignment was a self-directed learning exercise (SDLE). This course, taught seminar style, focused on the unique management issues facing technology firms and departments. The objectives for both classes were similar: encourage students to do a "deep dive" into an IS topic of their choice that relates directly to the Ukraine-Russia conflict of 2022.

Our qualitative measurements for success included increased student engagement, greater class participation, greater concept comprehension, and increased retention.

The outcomes from both classes were successful, based on classroom observations. Student interaction during class increased as they agreed, disagreed, and piggybacked onto each other's ideas. Reticent and introverted students were able to participate more fully. Last, students demonstrated greater critical thinking skills as they took concepts learned earlier in the semester and applied them with their current projects.

Grounded in the research on teaching with current events, self-directed learning, and multimedia assignments, this paper contributes to IS education through two examples of pivoting course plans to leverage current events and provides practical assignment details that educators can duplicate or modify for use in their own classrooms. The paper next proceeds with a review of the relevant literature, descriptions of our course modification case studies, the outcomes, and implications for IS education and related research.

2. LITERATURE REVIEW

Extreme Events in Teaching and Learning

Instructors have capitalized on current events for generations, yet few institutionalize the practice. Current events hold students' interest and provide real-world examples of classroom concepts (Cornely, 2003). The key characteristic about current events, particularly extreme events such as natural disasters, wars, and the like, are the human stories embedded within. It is these stories that stimulate student interest. Buffo (2015) and Pomykalski (2015) suggest four benefits of using these eventful stories in the classroom:

1. Grab student attention and make them focus on the class topic.
2. Prepare a fertile environment for engagement and discussion.
3. Build the connections between students and between students and the instructor.
4. Give quieter and less demonstrative students an opportunity to participate.

Teaching critical thinking

There is not much attention from the university faculty and educators to the fake news spreading around when an extreme event happens in the world. Weiss et al. (2020) suggest in their research that the faculty use different methods for education to teach the students recognize the fake news through the critical thinking. This shows how important it is for the faculty in IS to teach critical thinking skills to students, since IS is being used for coverage of all extreme events and analyzing the data these days.

Self-Directed Learning

Self-directed learning was first promoted in the 1960s and 70s and was primarily focused on adult learners (Ross-Gordon, 2003). However, we support the position that many of the principles of self-directed learning are appropriate for today's relatively sophisticated and globally-aware college students (Douglass & Morris, 2014), especially in technology majors where traditional learning may not adequately prepare students to step directly into industry roles. There are indications that classroom learning in technology skills may not transfer well to real world scenarios, decision making, and problem solving (Connolly & Begg, 2006). Self-directed learning, however, may be an antidote to these issues in our quickly changing environment, providing greater student engagement, motivation, comprehension, and retention (Morris, 2019).

There are several tenets to self-directed learning: 1) Self-directed learning views the instructor as a knowledge guide rather than a source or provider of knowledge; 2) Students are made aware that they are capable of creating knowledge; Students want to provide input as to how/what they learn; 3) Students are presumed to have internal motivations to learn, if they can be stimulated to activate it (Ross-Gordon, 2003; Tough, 1989); 4) Student autonomy in learning results in increased "autonomy, competence, relatedness, or purpose" (Douglass & Morris, 2014, p. 14); and 5) A goal of self-directed learning is student self-actualization (Morris, 2019).

Collaborative Learning

Collaborative learning encompasses a series of teaching methods that involve "joint intellectual effort by students, or students and teachers together" (Smith & MacGregor, 1992, p. 2). These methods may include group discussions, team projects, or student co-teaching (where students instruct each other). In collaborative learning, instructors are not purveyors of knowledge (similarly to self-directed learning) but change agents and guides (Bruffee, 1999). The tenets of collaborative learning include: 1) Learning is active, not passive, and in the best learning situations students create something; 2) Context is important and activities are grounded in problematic conditions to stimulate practice, analysis, and solutions; 3) Students each learn differently and bring diversity of perspective to the classroom which enhances learning; and 4) Social learning that involves a good deal of student interaction stimulates student engagement and "meaning-making" (Smith & MacGregor, 1992, p. 4). One particular form of collaborative learning is peer teaching, where students teach other students. The primary benefits of peer teaching include increased participation and proactive learning, and greater skills development (Goldschmid & Goldschmid, 1976). The involvement of students in the class through the discussions about different aspects of a specific topic and using different resources, makes them feel more engaged and also teaches them how to communicate as a team and share their findings (Heilporn et al. , 2021). This makes the students more engaged, makes the course more interesting, creates a trustful collaboration between students and helps them to analyze a topic through many different aspects of it.

3. CASE STUDIES

Pivot I: Midterm Exam

Required general MIS courses are common in business schools. Some business schools

Midterm
You will research an MIS aspect of the Ukrainian - Russian war of 2022, submit an essay, and give a minimum 5 minute presentation on your topic in class on March 10 using at least one slide. Therefore, you will have two deliverables in Canvas: your essay and at least one slide to be used in your short presentation in class. Combine them into ONE PDF file for submission. The essay should be a minimum of 400 words. There is no maximum. You may use any sources, but be sure to credit and cite your sources, use quotation marks when quoting directly, and avoid plagiarism. You are encouraged to use graphics, charts, images, tables, or other media. Use a 12 point font, Ariel or Times or similar. Use 1" margins. Add a header with your name, title, and page number. Your presentation slide(s) should be clear and to the point. You must have at least one slide but you may have more. Don't overcrowd and use plenty of white space. You can link to show a short video during your presentation but it should not be more than 2 minutes, unless it is you in the video. If you prefer, you may pre-record your presentation and play it in class. Video format styles can include a news report, TED Talk, original skit, etc. It is open for creativity. Just make sure the topic is relevant to MIS and the war.

Table 2. Midterm Instructions

stipulate the course for all BBA students while others require it only for IS majors. As a required course, it is often difficult to modify because of required teaching objectives. General MIS courses are often among the first prerequisites for later IS classes, and also frequently offer multiple sections.

This particular course had a midterm exam and a final. Both were a combination of 25 multiple choice questions (mostly on definitions and terminology) and an essay question (integrating and synthesizing concepts). In light of the recent Ukraine-Russia conflict, the instructor made two changes. First, the traditional in-class midterm exam was exchanged for a new one-week midterm project containing an essay and a short in-class presentation to be given on the original exam date. Second, the last class before the exam day was given over to review in the form of an in-class Jeopardy game on terms and definitions (JeopardyLabs, 2022).

Students were given a week to complete the project. The instructions given are presented in Table 1 and the grading rubric used for the assignment is provided in Appendix A.

Pivot I Outcomes

Project topics were quite varied, although, understandably, cyberattacks (in general) covered a third of the submissions. While many students discussed cyberattacks in general, several opted to dig into specific types of attacks, such as wipers. The prospect of tech firms and fintech cutting ties with Russia was also a popular topic as students explored ethical dilemmas, risks, and potential outcomes. This included essays on firms in general, as well as deeper views into specific companies and the impact of their leaving. AI and its various aspects, such as disinformation, deep fakes, autonomous drones and vehicles (both on land and submarine) was another popular topic. Several students looked into actions that specific firms were taking in the war, serving as privateers if you will, such as Microsoft and Starlink. The hacktivist group Anonymous garnered special attention from a few students, while others focused on societal impacts of the digital war. Table 2 summarizes the project topics.

The presentation part of the midterm resulted in variety, as well. The types of presentations ran the gamut from a single slide with bullet points from which the speaker lectured to seven minute pre-recorded videos. Some of the standout presentations included "TedX Ukraine" - a Ted Talk style video, an employee cyber awareness video (for a fictional company) on cybersecurity protocols and company IT strategy during the war, a presentation with accompanying slides and video on social media in war (including emotional video of children singing in bomb shelters), and detailed exposés on AI powered military equipment. Table 4 summarizes the types of presentations, which include Video, Presentation with complex slides/media (the most popular), and Presentation with simple slide(s). Note that some students were able to give compelling presentations because of their deep topic knowledge despite using only a few simple slides.

Topic	# of Submissions
Cyberattacks as part of warfare strategy, cyberterror counter warfare	10
Tech firms cutting ties with Russia, fintech & electronic payment services terminated, social media platforms leaving	5
Digital disinformation, AI & disinformation	4
The role of AI in warfare, weaponized AI, autonomous vehicles	3
Russia's Heremitic Wiper Attack - Malware	2
Anonymous, hacktivists	2
Starlink	2
Everybody participating in the war (states, firms, individuals)	1
Microsoft's counterwar on Russian cyber attacks	1
Digital iron curtain	1
Ethical questions of social media platform moderation in times of crisis	1
Social media & modern warfare	1
Digital communication & transparency in modern warfare	1
TOTAL	34

Table 3. Project Topics

Student engagement was observed to be higher than normal during this project, both in the week of preparation (the instructor received a number of requests for feedback on the choice of topics) and in the resulting submissions. A number of students who had been performing satisfactory "B" work were able to bump their grade with an "A" level midterm, thanks to their increased engagement with the topics and opportunity to self-learn. Unfortunately, there are always a few who do the minimum and this course was no exception, but it was only a few people.

A favorable outcome of this revised midterm was the ability to not only evaluate where students were in terms of comprehension and retention but also how they applied critical thinking and used analysis skills developed during the first half of the semester. The fictional employee cyber security seminar video is an example of this. The student approached the project as a video to be distributed to employees of a fictional firm. The objective of the video in this context was to apprise staff of the organizational cyber risks posed by the Ukraine-Russia war, how it might impact the company, precautions employees should be taking, and steps the company was taking to mitigate risks. The student organized his presentation as follows in Table 5.

Presentation Types	
Type	**Count**
Video	6
Presentation with complex slides/media	18
Presentation with simple slide(s)	10

Table 4. Presentation Types

Another student organized her project as a case analysis of social media in modern warfare. Her table of contents is shown below to illustrate the level of organization applied, as shown in Table 6.

Current Situation:	• Forbes video "How Hackers Are Waging A Cybersecurity War During The Ukraine-Russia Conflict" • How the situation affects our company
Short Term Plan	**Long Term Plan**
Steps to be implemented immediately to reduce the risk of being the victim of stray cyberattacks, directed or otherwise.	*How we plan to improve our information security and risk management in the long run.*
Employees • Watch out for suspicious emails/links • Phishing is still the #1 cyber scam • Password diligence **Company** • Coordinate with industry/law enforcement • Establish alternative communication channels • Implement no retaliation policy for employees reporting security lapses	**Consultants** • Bring people in to eval. our info security • Implement their recommendations **Cyber Incident Response Plan** • Business continuity plan • Have processes in place should we go offline **Continued relationship with industry & feds** • Communicate with industry peers • Get on mailing lists of CISA and FBI **Examine supply chain** • Phase out Russia reliant code • Carefully vet source code and engineers

Table 5. Student Video Organization

Table 6. Student example of case study format

An example of the format that students use for writing their case analysis is presented in Table 6.

Term or Concept	**Definition**	**Example**	**Sources & Citations**
Essay (150 words minimum)			

Table 7. SDLE Template

A third example is a traditional essay totaling around 1350 words (the assignment minimum was 500 words). The student spent considerable time researching many aspects of digital disinformation, providing appropriate definitions, examples, references, quotes, and graphs. The corresponding presentation incorporated all this and more in a compelling talk. All these examples demonstrated creative, personal choices in how students approached the subject, synthesized the learned material, and applied it.

Another benefit of this pivot resulted in increased class participation and interaction. When students teach other students about these current topics, attention is high. In most cases, students jumped in with questions for the speaker and often this would lead to the speaker accessing additional impromptu material on screen, such as a relevant YouTube video, newscast, website, or Twitter post. In one presentation on AI, the discussion turned to fake images created by AI and the speaker immediately advised the class to use their cellphones to access https://this-person-does-not-exist.com/, a website that generates random AI Photos of (not real) people. Upon accessing the site, each person would see a different highly believable image. The entire class participated, accessing the site and showing their phone around with varied realistic images of babies, old women, young men, etc. The discussion then evolved into how fake images like these can be identified and the class joined in pointing out flaws in the various images.

While some of the speakers were extroverted and good presenters naturally, there are always some shy students who don't do well in presentations. By allowing students to present a prepared video instead of a live presentation, these shy students were still able to participate fully. Many used their new medium creatively and effectively, going over and above a traditional "talking head' narration of a PowerPoint recorded on Zoom.

Pivot II: Self Directed Learning Exercise

A commonly used assignment that promotes independent development is the Self Directed Learning Exercise (SDLE) (Mawdesley & Al-Jibouri, 2010). In our case, the masters-level Management of the Technology Organization course requires weekly SDLEs. The template includes a definition, real world example, and a short essay describing the phenomenon in the student's own words. The template is illustrated in Table 7. SDLEs are typically used in our classes as a complement to more structured work and instruction, such as textbooks or lectures. The SDLE encourages students to find a particular aspect of the topic at hand that interests them and gives them the opportunity to explore it in depth. SDLEs are submitted for grades each week but are also used for class discussion, allowing students to share what they learned. The interesting thing about this exercise is that even when students select the same term or concept, how they approach it often differs considerably. This variance gives students the opportunity in class to see how taking a different perspective, changes how an issue is perceived.

SDLEs are supposed to be submitted by students every week about the MIS topic of that week. The students need to provide resources for their essays and make sure those resources are relevant. In the same week, the students get to present their SDLE's in the class and there will be an open discussion opportunity for all students to share their SDLE's. Finally, the resources used by different students are shared through the course webpage.

Pivot II: Outcomes

The pivot for SDLEs directed students to focus on MIS aspects of the Ukraine-Russia war. These resulted in varied topics, such. as the role of private technology firms in supporting Ukraine, Ukraine's internet military recruiting strategy, and hacktivist participation in the war. One of the more interesting SDLEs compared Russian cyber-attacks on Ukraine to ancient Greek armies lobbing dead cows over city walls to sow fear and panic. We also noticed an increase in average essay length for these SDLEs compared to other weeks. Normal weeks averaged 150-175 words, however, the current event SDLE essays averaged 200-250. Last, there was an increase in class discussion around the SDLEs as students listened and then offered another example of the phenomenon or refuted it as fake news (citing verification websites and sources). These lively discussions helped drive home the concepts, increasing both comprehension and retention. In general, pivot II lets the students to freely search and present topics relevant to MIS aspects of Ukraine-Russia war. In these SDLEs every week they did the same for that week's topic. However, this week, the students showed more interest and found it challenging. They had to find reliable sources and distinguish correct news. Presenting those SDLEs in the class was also very engaging since different aspects of the topic and similarities and differences between different sources could be compared.

4. DISCUSSION AND IMPLICATIONS

This paper illustrates how current extreme events may be leveraged to increase student engagement and improve student success in IS courses. Maintaining relevance is critical for all educational fields, but we suggest it is even more important for IS education, as technology changes so quickly. Instructors in IS courses must be diligent in keeping course material up to date and in line with industry expectations or risk poor student outcomes in terms of job placement, starting salaries, and department reputation. Incorporating current events, especially critical events such as war, not only increases course relevance but also significance and value. It provides students with new practical knowledge, new theoretical knowledge, and broadened perspectives on the role of IS in a greater context. It also gives them additional material to discuss in job interviews and recruiting events.

Another aspect of these pivots is that students quite simply enjoy them. While there may be a few students who dislike changes in the syllabus, most are excited about the opportunity to explore historic events through the lens of class subjects. It increases course relevancy and demonstrates course value in a tangible way. Students see firsthand that what they are learning has real world applicability and worth. While the Ukraine Russia war has offered a plethora of IS topics for study, it is not unique. Past events have been utilized by faculty in the same way. The recent Covid-19 pandemic, for example, has provided a number of opportunities. These include essays, reports, data analysis and visualization assignments using a range of open Covid data sources. Topics included open data and digital epidemiology, the ethics of digital tracking and monitoring of populations during pandemics, the rise of work-from-home and digital communication technologies, and the role of social media in public sentiment about the pandemic. In short, when pivoting to current events, the following steps can be taken.

1. Identify the current event. Provide a clear scope of what is and is not to be included.
2. Identify how students can approach the current event in their assignments. This might include regular assignments or assessments such as a midterm or final.
3. Explain why you have chosen to make this course plan modification and the benefits you anticipate from it. Try to get the students excited about it.
4. Provide examples for students and offer suggestions as to the different formats or media you will accept.
5. Encourage a range of submission types so that every student can find a format they are comfortable with and can then focus on their best work.
6. Provide a clear rubric for grading.
7. Consider providing a longer preparation time than usual. For media and presentations, at least a week of preparation is recommended.

5. CONCLUSIONS, LIMITATIONS AND FUTURE RESEARCH

Educators are always challenged to maintain student engagement and keep courses relevant. Utilizing current events, especially momentous events, provides a unique opportunity to analyze history in the making through the lens of your course subjects. Such analysis enables students to place their coursework in a greater context and stimulates intellectual achievement and engagement. Through this assignment the students with MIS background learn to understand the role of MIS in the extreme events in the world of today. This brings a new insight for students since most global companies using MIS can be affected by such events. Using principles from both guided independent learning and collaborative learning, pivoting courses to leverage current events offers IS instructors another tool for ensuring student success. Some limitations in this study are that the extreme event used in the class is vastly dynamic and information about it changes every day. Also, there might be many aspects of such events that can be missed while studying due to confidentiality and incorrect news spread from different sides in a war.

For future research, we suggest using other current events, advances and concerns in AI and communication systems security during extreme events as cases in the class to make the students interested and prepared for their potential future jobs.

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Appendix A

Essay and Presentation Rubric

Criteria	Pts
This criterion is linked to a Learning Outcome Minimum requirement met The minimum word count and slide count have been met. If the submission exceeds the minimum significantly, extra points may be awarded.	5 pts
This criterion is linked to a Learning Outcome Relevance & Substance The topic is relevant to the assignment and is supported with real world examples to support the author's opinions.	75 pts
This criterion is linked to a Learning Outcome Mechanics The submissions are written with good grammar and are devoid of typos and other writing errors.	10 pts
This criterion is linked to a Learning Outcome Format & Style The submissions use the described format requirements, slides are clear and not overcrowded, images are cited. If the submission goes over and above, extra points may be awarded.	10 pts
Total Points: 100	