Instructional design for a virtual IT course during the COVID-19 pandemic

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ABSTRACT

The COVID-19 pandemic has affected every aspect of our lives, including instruction in the higher education system. In this sudden and stressful change, faculty had to explore different opportunities and technologies to continue to deliver quality instruction to their students. Instructional design has always been an important topic for education researchers and practitioners, and has become even more so in these challenging times. This paper presents an example of instructional design of a database course delivered virtually during the pandemic, using cloud-based tools and resources. The course employed cloud-based technologies, both synchronous and asynchronous. This paper discusses the process and tools that were used as well as the challenges encountered. The instructional design methods presented here can also be used in the post-COVID-19 era.

Key words: instructional design, virtual course, COVID-19 pandemic, online teaching

1. INTRODUCTION

At the onset of COVID-19 pandemic, many universities were forced to switch to online instruction. Faculty embraced online teaching and adopted online educational tools and resources as one of their collective responses to delivering instruction while staying safe and maintaining social distancing. However, the level of difficulty or challenges encountered by each academic discipline when transitioning to a virtual format are different. The focus of this study is the information systems (IS) discipline. Designing and delivering online courses in the IS or IT area has its own challenges, in particular for courses that traditionally incorporate hands-on activities such as programming, database development, networking courses, etc.

While there has been a significant amount of research on online learning in general, the design and delivery of online computing courses that are more technical in nature is an area that is less researched. The purpose of this paper is to contribute in filling this gap by describing the design and delivery process of a virtual database related course. It describes our experience of examining and re-designing a course titled "Data Resource Management" from the in-person to the virtual delivery format.

This paper is structured as follows: first, we review the relevant literature on online learning, instructional design and adoption of cloud computing in education. Then, the paper describes the course, before and after the redesign process. We discuss the modifications implemented in this course, methods and tools employed during its transition to the virtual format. The paper concludes by summarizing our experience, benefits of this course design as well as challenges encountered.

2. LITERATURE REVIEW

Literature review on online learning

As online education has increased in popularity in the last decades, there has been a significant amount of research that has identified and discussed its benefits, challenges, and various aspects of instructional design. Delivering quality instruction has always been an important issue for education researchers and practitioners, including online education. One such endeavor to improve the quality of online courses is the National Standards for Quality (NSQ) Online Learning project, which establishes the (NSQ) standard sets including Online Courses, Online Teaching, and Online Programs.

Factors that affect online teaching effectiveness have been widely discussed and researched. An interesting study on students' perceptions of quality online education by Zhang et al. (2020) identified seven critical success factors. These factors are: 1) basic online modality (e.g., online gradebook), 2) teaching presence (e.g., customized feedback), 3) instructional design (clarity of structure and communication), 4) cognitive presence (e.g., intellectual stimulation), 5) social or student-to-student presence, 6) online social comfort (comfort interacting online), and 7) interactive online modality (e.g., videoconferencing and small groups). They also found that factors 1, 2, and 3 rank high for students.

A common theme in many of these studies is student engagement. 'Social presence' is frequently cited as a contributing factor to increase student engagement, retention and satisfaction with the course (Zilka et al., 2018; Muljana and Luo, 2019). Perceived instructor presence has been shown to affect positively the student engagement and satisfaction with the

course (Park and Kim, 2020). Some Learning Management Systems and technologies such as videoconferencing can be used to enhance social presence.

While most of the studies on social presence have focused on asynchronous learning, there is a growing body of research involving blended and synchronous learning (Mykota, 2018). This delivery format is considered as an approach to address some of the issues with social presence evident in the fully online format. Yamagata-Lynch (2014) concluded that synchronous delivery modes can provide a stronger sense of connection among students, and a blended online synchronous and asynchronous course can strengthen social presence. Bower et al. (2015) illustrated that blended synchronous learning resulted in more active learning and a greater sense of community for students. Francescucci and Rohani (2019) investigated VIRI (Virtual, Interactive, Real-time, Instructor-led) online learning compared to F2F delivery format in a marketing course. They concluded that synchronous course delivered using VIRI classroom technology had the same level of student performance outcomes as F2F classroom experience.

Studies focusing on online IS or IT related courses present mixed results when it comes to the effectiveness of these courses and student satisfaction. For example, He and Yen (2014) compared various delivery methods in a programming course and found that students are more satisfied with the face-to-face delivery method compared to satellite broadcasting and video streaming. Settle and Settle (2007) found that distance learning students in an introductory Java course were less satisfied than their peers in live sections of the same course.

Literature review on instructional design

Instructional design is an important factor that affects the quality of online learning. A study of e-learning in multiple institutions by Salyers et al. (2014) concluded that instructional design elements such as course design and ease of navigation were critical to e-learning. They also concluded that faculty needs to recognize that e-teaching requires design expertise and delivery skills. In a study of online MBA courses, Sebastianelli et al. (2015) found that in addition to course content and faculty-student interaction, course structure was an important factor related to perceived learning and course satisfaction. Markova et al. (2017) also concluded that faculty commitment to instructional design and delivery is key for creating effective virtual environments. In the context of blended learning format, Zhang and Dang (2020) found that the instructional design factor can influence blended learning success. Their study indicates the importance of course design, such as the development of class activities and instructional methods that can effectively support both the offline and online course activities. In a systematic review of 40 studies, Muljana and Luo (2019) found that course design has been identified by many of these studies as a factor that influences satisfaction with the online course and student retention.

Several instructional design guidelines and models have been proposed. Hack (2016) proposed a hierarchical instructional design model for blended higher education. This model has four levels. At the bottom level (Level 1), much of the work involves assessment of needs and resources, analysis of learner, and stating goals. Some of these are pre-defined or provided for the instructor. Level 2 includes development of objectives, “blending and sequencing”, and design of learning activities. Objectives are focused solely on the learner and provide a specific guide to what the instruction is to accomplish. When making blending decisions, there is no best approach or formula. The study indicated that a basic sequencing strategy would be to establish a hierarchy of the content, which places all of the prerequisite competencies in an ascending order,

with competencies that are dependent upon subordinate skills placed on higher tiers. The design of learning activities refers to reviewing each objective and its related content to determine the best instructional strategies and delivery methods. Level 3 includes development of assessment strategies, delivery and getting feedback. The last level activities involve analysis and revision. This study also pointed that the development of instruction for higher education should emphasize less on front-end analysis since many factors are determined by accreditation standards, admissions standards, course prerequisites, and an institutional standardization of classroom and technology configurations. The author believed more time and attention should be given to the creative process of developing objectives, designing learning activities and assessments, as well as making informed decisions on blending, sequencing, and delivery technologies.

The course redesign described in this paper followed this model. In general, studies have pointed out that there is no perfect mix of pedagogical and technological factors for faculty to focus on because the situational and student preferences vary so substantially for course to course (Zhang et al. 2020).

Literature review on adoption of cloud computing in education

Cloud computing technologies were key in supporting the new delivery format and redesigned activities in the course discussed in this paper. This section presents some of the findings of prior research on use of such technologies and tools in education.

Qasem et al. (2019) conducted a systematic literature review of studies on cloud computing adoption in higher education. They concluded that cloud computing technology is one of key technologies that will have a significant impact on higher education. This topic remains an ongoing and emerging subject, which requires further research. Scalera et al., (2020) conducted a systematic study about the interest in teaching methods, techniques, and tools based on cloud computing. Their analysis of 160 articles concluded that areas that have attracted the most interest from the research community are those of the new learning environments, collaboration platforms, and virtual labs. However, these are also areas that are less researched and need more exploration by the scientific community.

Adoption of cloud computing tools is even more important in the information system curriculum. Not only they support course delivery, but also introduce students to environments and skills that are considered important by employers (Cummings and Janicki, 2020). Mew (2016) addressed the potential of cloud computing for IS education, especially for security, database, networking, and application development courses. This study also described the use of Microsoft Azure for a networking course and a virtualization course. Pike et al. (2017) describe their experience with using Azure in a web development course. They found that students using the cloud-based environment reported similar learning experience to students using the local based learning environment, but they encountered greater difficulties than anticipated in gaining proficiency with the cloud technology. Schuff & Doyle (2020) described the successful redesign of an MIS infrastructure course using cloud technologies.

The purpose of this paper is to contribute to the research in these areas in two ways: First, illustrate the use of cloud computing technologies in IS/IT courses by describing the design and delivery of a virtual database related course using cloud technologies. Second, explore how these technologies can support a hybrid course delivery format. Prior studies present mixed results of the effectiveness of online computing courses and student satisfaction. However, the technology

that can be used to support these courses has advanced and is important to explore the impact that these new technologies such as cloud computing and videoconferencing can have on the outcomes of this delivery format.

3. ONLINE COURSE DESIGN PROCESS

This section provides information about the course before its redesign, followed by the description of modifications of the course activities, teaching methods, tools and delivery format.

Course background

The course described in this paper is a required course in a Big Data Masters' program within college of business at a small midwestern university. It is also offered as an elective for undergraduate Computer Information Systems and Big Data majors. The course is titled "Data Resource Management", it is 16 weeks long and offered twice a year during Fall and Spring semesters. It is aimed at those new to advanced database schema objects, cloud-based database services, basic database structure, security management, and interested in database application and database related programming. This course has two prerequisites for undergraduate students. Introductory programming knowledge with any object-oriented language is required. Typical languages students learn are Java, C# and Python. The other required background knowledge is fundamental relational database knowledge such as data modeling, normalization, and basic structural query language (SQL).

Students enrolled in this class are either senior undergraduates or students admitted to the master program. The class size is typically 25 to 35 students. Typically, there are 5 to 10 undergraduates students enrolled in the course and the majority of students are graduates. Most of the graduate students in the course are international students from Asian countries with little computer related knowledge or IT related work experience. Many of them have prior education or work experience in fields such as mechanical, electric, electronic, or chemical engineering.

Table 1 presents the learning objectives of the course before its delivery and content redesign. The main course objective is for students to be able to carry out database development and data analysis tasks in the context of business problem solving.

1. Use the advanced database concepts such as views, sequence, synonym, index
2. Write advanced PL/SQL programming blocks such as triggers and stored procedures
3. Know how to use ADO.NET to build API with Oracle DBMS
4. Administrate Oracle database including backup, recovery, and security
5. Know how to build multi-media database with Large objects
6. Understand the concepts of concurrency control and transaction management.
7. Know how to use Oracle Data Miner.

Table 1. Course learning objectives prior to redesign

Technical Settings and Teaching Methods

This course emphasizes hands-on skills. Course activities include several hands-on exercises, assignments, and projects. All hands-on activities took place in the department computer labs. Oracle is used as the database management system because of its popularity in the industry. Oracle is pre-installed and configured by the instructor in one of computers that has similar hardware and software configuration. Then an image was built and ghosted to each computer in the lab. Later on, the image was also ghosted to laptops so that students can check out the laptops as needed, but these laptops are restricted for use on campus only and they must be returned by the end of the day.

There are several issues with this approach. Installation of Oracle in lab computers is a time-consuming process. In addition, installation and use of Oracle requires administrative user privileges, which expose the campus computers to security risks and is against the lab security policy. As such, this software could only be installed in designated labs only. These labs are used for several courses, which could create availability issues for students. Software compatibility was another issue. Most of other applications installed in the lab are Windows based, which can be an issue when using Oracle in the Microsoft development environment. Finally, many resource consuming software applications installed in these computers, caused them to become slower. For instance, Oracle BigDataLite was installed for a big data course, which allows students to build the multi-node Hadoop cluster. However, BigDataLite requires the use of a virtual machine management system such as Oracle VirtualBox.

Based on the course requirements decided by the program, a text was edited by the instructors for this course. This is because the textbooks available on the market are either professional-oriented or research-oriented. Especially, most of the examples and exercises in the available textbooks are not workable in our lab settings. Therefore, it was necessary to have a student-oriented textbook with examples and exercises replicable in the school's lab settings. The text is distinguished by integrating Oracle products into Microsoft development environment, processing large data type (multi-media), and business exercises. Each chapter is accompanied by the teaching aids such as PowerPoint slides and homework. By using this text, students have benefited not only academically, but also financially. Many students have provided positive feedback on this text and some of them even use it in their professional work for training purposes after they graduated.

Prior to Fall 2020, instructional methods used in this course included traditional in person lectures, classroom-based lab activities, and faculty-student consultations and outside class interactions. Most of the lab activities were demonstrated in class first, with written lab instructions provided in Blackboard. Blackboard has been utilized over the years as a platform for students to access all course learning materials including text hand-out, lectures notes, lab instructions, tutorials, assignments, grades, and so forth. Even examination activities were conducted on this platform.

Course redesign

This section describes the transition of the data resource management course to the virtual format due to COVID-19 pandemic. This transition brought about modifications in course design, use of technology, content structure, class activities, and assessment strategies which are discussed next. Prior to discussing the technology used in this course, it is important to clarify

and define the delivery format. Dumont and Raggo (2018) summarized different delivery formats and presented each scenario based on two dimensions: course timing and mode of delivery. This categorization is presented in Figure 1.

		Course timing	
		On-campus	**Online**
Mode of Delivery	**Real-Time (Synchronous)**	Classroom setting and face-to-face interaction	Synchronous interaction through learning management system (LMS)
	Hybrid	Synchronous and asynchronous classroom setting and university LMS	All content delivery through LMS, both synchronous and asynchronous
	On-Demand (Asynchronous)	LMS course delivery and on-campus office hours	All content delivered asynchronously and office hours online only

Figure 1. Course Delivery Matrix by Dumont and Raggo (2018)

The course being discussed in this paper falls in the category of "Online, Hybrid". In this delivery mode, content is delivered both synchronously and asynchronously. Synchronous activities include faculty holding virtual meetings, including lectures, during which students log on to the designated online platform. Asynchronous activities use the learning management system to share and manage teaching materials. A major benefit of this format is the potential for greater interaction, which is very important for technical lab activities (Dittrich and Maltry, 2020). It can maximize the benefits of both synchronous and asynchronous teaching.

The course design relies heavily on instructional technologies. The instructional technologies and tools used are addressed next.

Instructional technologies

Continuing the use of Oracle in the new format could present these issues:

- Requiring students to install and configure the software could be problematic in terms of software licensing, which is difficult to manage in student computers.
- Installation, configuration and use issues could arise due to various operating systems or versions of operating systems installed in student computers.
- When students install the software in their personal computers, the inconsistent computing power and settings could impact the execution of course activities and create uncertainties or challenges in the new course delivery format. For more powerful computers, it may take about a couple of minutes to start Oracle; for less powerful computers, it may take as long as 5 minutes to start.

As indicated by research, cloud infrastructure can provide solutions to these problems. Cloud computing can help build a distance learning environment with various on-demand

services that have high reliability, scalability and availability. Figure 2 summarizes cloud technologies employed in the redesigned course.

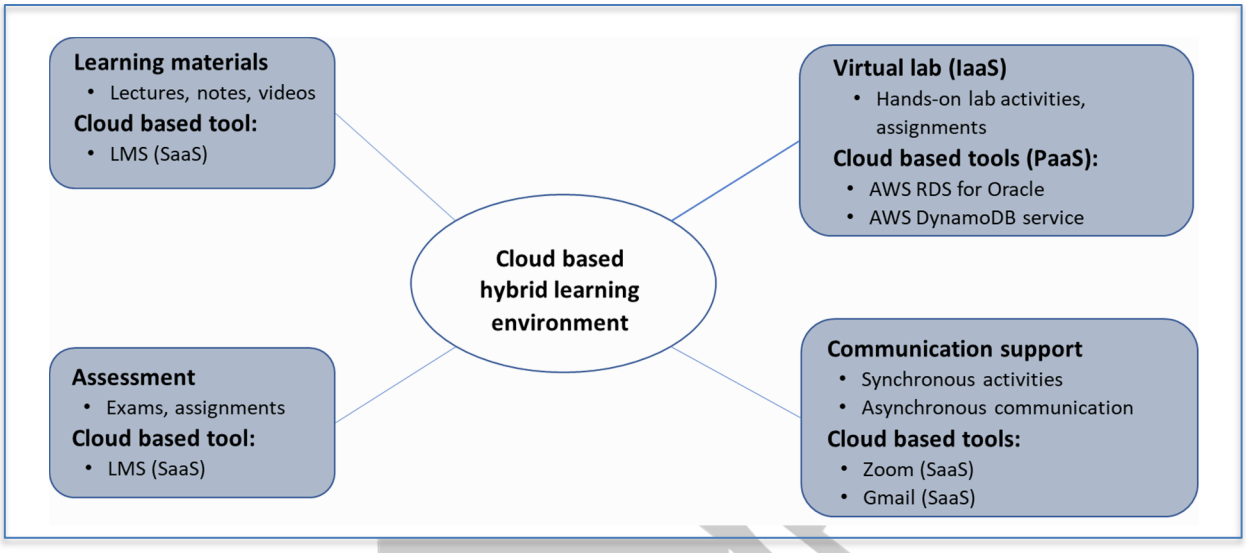

Figure 2. Cloud based technologies used in the course

Virtual lab

Currently, the major cloud-based service providers are Amazon Web Services (AWS), Microsoft Azure, and Google. Oracle is also one of the leading solution providers. However, due to Oracle's slow response to cloud-based service, AWS Cloud was selected for this course. Most people know Amazon for its namesake e-commerce platform, but AWS is one of Amazon's strongest revenue segments. Amazon provides resources specifically targeted to education. AWS Educate is Amazon's global initiative to provide students comprehensive resources for building skills in the cloud. Through the Educate account, instructors can enroll the students for the class and can monitor the expense detail of each student.The following services were used in the course: 1) Amazon Relational Database Services (RDS) for Oracle service was used as a platform for relational databases, 2) DynamoDB service was used for non-relational databases, and 3) Amazon Elastic Cloud Computing (EC2) was used for virtual lab computers for Oracle client software (Oracle SQL Developer) and database application development. The two first services fall in the category of Platform as a Service (PaaS) and the later one in the category of Infrastructure as a Service (IaaS).

Communication support

Videoconferencing Tools

Due to COVID pandemic, adoption of videoconferencing technologies experienced a significant increase in higher education similar to other educational and organizational settings. Applications such as Zoom, Microsoft Teams, Skype and Webex continue to be widely used as a

collaborative tool and is predicted they will remain a relevant teaching tool even when work environments go back to normal.

For this course, Zoom was used to support synchronous teaching activities such as class lectures, demonstrations, short discussions, assignment reviews etc. The chat feature in Zoom allows students and teacher to communicate both privately and publicly. Zoom also allows instructors to record the class so that students can replay it for class review purposes. In addition, Zoom also provides a venue for students to communicate with faculty outside class such as office hours.

Email System

Google email system is used in asynchronous communication as a supplementary tool for the class support and consultation purposes. For example, when students have assignment questions or have system errors, they can write emails with screenshots in the attachment to get more effective help. Some announcements from the instructor are also made via emails.

Learning management system

Numerous learning management systems are available for instructors to support the delivery of in person, blended and online course formats. Virtually every educational institution employs one and they remain important tools to support various aspects of learning. As described in the literature review, learning management system is one of the technologies that can be used to increase social presence in online courses and support social learning. The learning management system used in this course is Blackboard. One of the benefits of a learning management system such as Blackboard is to provide a centralized access to course materials. This became especially important in this course where a variety of tools, platforms and activities are employed.

Blackboard was also used in the previous format of this course, but its role in the new format became more important. Similar to an online course the presentation of the course content was modified and organized using tree structures. This way, the system helps with providing the big picture of the course structure. Besides lecture notes, the course content also includes handouts, tutorials, external resource links, assignments, quiz questions etc. It also included a gradebook to manage the student grades for each course activity.

Course Content Modifications

Course content was revised to reflect the technological changes. The teaching/learning objectives were revised to achieve three goals:

1. Continue to meet the main learning objective of this course in the degree program: Provide fundamental data processing knowledge and skills
2. Introduce cloud-based technologies to create a teaching/learning environment
3. Prepare students for the data analytics field (e.g. to earn AWS certificates for Data Analytics)

Cloud technologies allowed the faculty and students to focus on the database application rather than database administration. The database administration work is transferred to cloud service providers. Table 2 presents the modified course objectives and Table 3 presents course activities.

1. Review relational database design process, concepts, basic SQL knowledge and skills
2. Know AWS cloud database service
3. Learn advanced database schema concepts such as views, sequence, synonym, index
4. Write database applications with PL/SQL blocks such as triggers, functions, and stored procedures
5. Understand Oracle database security
6. Understand Oracle database structure
7. Understand Python Database API
8. Know how to use Python to build API with cx_Oracle module
9. Learn how to use Non-relational Databases
10. Learn web Restful API with Python

Table 2. Modifies course learning objectives

Learning Objectives	Teaching Content	Activities	Assessment Strategies
1	Relational database concepts and terminologies Oracle SQL Developer download and installation Design process from Logical Model (Relational Model) to Physical Model (Database Model) with Oracle Data Modeler SQL (DML, DDL)	1. Student self-work to download and install following written tutorial provided 2. Demonstration by designing a small database with Oracle Data Modeler	Individual project Exam essay question to describe the major processes
2	Create AWS educate account Introduce AWS RDS services Create a database instance with Oracle Engine	1. Student self-work prior to class using written tutorial provided 2. Class demonstration	
1, 2	Database Implementation Basic SQL knowledge and skills	1. Using Oracle SQL Developer to connect with AWS RDS instance 2. Class demonstration and practice SQL	
3	Schema objects: view, sequence, synonym, index	Lecture with examples	Assignments 1, Quiz
4	PL/SQL blocks triggers, functions, stored procedures	Lecture with examples	Assignments2, Assignments3, Assignments4, Quiz, Exam questions
5	Database Security Authentication Authorization Access Control Matrix Audit trial	Lecture with examples	Quiz, exam questions

6	Terminologies of instance, tablespace, datafiles, blocks, memory management	Lectures Reading	Quiz, exam questions
7	Python Database API	Tutorial: Install Python and Visual Studio Code Lecture, examples Class demonstration	Quiz
8	Python and cx_Oracle	Lecture, examples Class demonstration	Assignments5
9	NoSQL databases introduction AWS DynamoDB MongoDB	Lecture, examples Class demonstrations	Assignments6, Quiz
10	Web Restful API	Lecture, examples Class demonstrations	Assignments7, Exam

Table 3. Course content, activities, and assessment strategies

4. CONCLUSIONS

The COVID-19 pandemic created challenges, but also provided opportunities for faculty in higher education to explore different ways of teaching using cloud-based technologies. The course redesign presented in this study is an example of taking advantage of such opportunities. Prior to pandemic there were no plans to teach this course online or hybrid. The new environment accelerated both adoption of new cloud-based technologies and experimentation with the hybrid delivery format. Implementing a virtual lab environment provided several benefits such as standardized software configurations and consistent lab environment, 24/7 accessibility and availability, support for special requirements in the context of online courses and potential for cost-savings and improved performance.

In terms of issues, some students encountered network issues. Their connection might be dropped without the instructor being aware of it. Another observation is related to lab activities. For these activities, students may need two devices: One device to view the demonstration or display the instructions; the other for hands-on exercise and practice.

Our experience not only illustrates the adoption of cloud-based technologies in education, but also the potential of hybrid course delivery formats in technical courses with hands-on activities and labs. As indicated by research, social presence of both faculty and peers is an important factor that increases student engagement. The use of a videoconferencing tool aimed at maximizing social presence in this course. Preliminary analysis of student feedback indicates positive perceptions of the revised course design and technological tools employed. More detailed analysis of student experience and perceptions and how they will be incorporated in future offerings of this course will be discussed in a separate study.

From the instructor perspective, the experience was positive and successful and students appreciated learning and using relevant technologies such as those based on cloud-computing.

REFERENCES

Bower, M., Dalgarno, B., Kennedy, G., Lee, M., Kenney, J. (2015). Design and implementation factors in blended synchronous learning environments: Outcomes from a cross-case analysis. *Computers & Education*, *86*, 1-17.

Cummings, J., Janicki, T. N. (2020). What Skills Do Students Need? A Multi-Year Study of IT/IS Knowledge and Skills in Demand by Employers. *Journal of Information Systems Education, 31*(3), 208-217.

Dittrich, J., Maltry, M. (2020). Database (Lecture) Streams on the Cloud: An Experience Report on Teaching an Undergrad Database Lecture during a Pandemic. *arXiv:2010.07011*.

Dumont, G., Raggo, P. (2018). Faculty perspectives about distance teaching in the virtual classroom. *The Journal of Nonprofit Education and Leadership*, *8*(1).

Francescucci, A., Rohani, L. (2019). Exclusively Synchronous Online (VIRI) Learning: The Impact on Student Performance and Engagement Outcomes. *Journal of Marketing Education, 41*(1), 60-69.

Hack, G. (2016). An instructional design model for blended higher education. *Journal of Learning and Teaching in Digital Age*, *1*(2), 2-9.

He, W., Yen, C. (2014). The role of delivery methods on the perceived learning performance and satisfaction of IT students in software programming courses, *Journal of Information Systems Education*, *25*(1), 23-34.

Markova, T., Glazkova, I., Zaborova, E. (2017). Quality issues of online distance learning. *Procedia-Social and Behavioral Sciences, 237*, 685-691.

Muljana, P. S., Luo, T. (2019). Factors contributing to student retention in online learning and recommended strategies for improvement: A systematic literature review. *Journal of Information Technology Education: Research,* 18, 19-57.

Mykota, D. (2018). A Scoping Review of Social Presence. *International Journal of E-Learning and Distance Education*, *33*(2).

Park, C., Kim, D. (2020). Perception of instructor presence and its effects on learning experience in online classes. *Journal of Information Technology Education: Research*, *19*, 475-488.

Qasem, Y.A., Abdullah, R., Jusoh, Y.Y., Atan, R., Asadi, S. Cloud Computing Adoption in Higher Education Institutions: A Systematic Review. *IEEE Access, 7*, 63722 – 63744.

Salyers, V., Carter, L., Carter, A., Myers, S., Barrett, P. (2014). The search for meaningful e-learning at Canadian universities: A multi-institutional research study. *International Review of Research in Open and Distributed Learning*, 15(6), 313-337.

Scalera, M., Gentile, E., Plantamura, P., Dimauro, G. (2020). A Systematic Mapping Study in Cloud for Educational Innovation, *Applied Sciences, 10*, 4531.

Sebastianelli, R. Swift, C., Tamimi, N. (2015). Factors Affecting Perceived Learning, Satisfaction, and Quality in the Online MBA: A Structural Equation Modeling Approach, *Journal of Education for Business*, 90, 236-305.

Settle, A., Settle, C. (2007). Distance Learning and Student Satisfaction in Java Programming Courses. *Journal of Universal Computer Science*, *13*(9), 1270- 1286.

Schuff, D., Doyle, M. (2020). Deploying APIs in the Cloud: A Novel Approach to the MIS Infrastructure Course. *Americas Conference on Information Systems Proceedings*. 18.

Yamagata-Lynch, L. (2014). Blending online synchronous and asynchronous learning. *The International Review of Research in Open and Distance Learning,* 15 (2), 189-212.

Zhang, Y. G., Dang, M. Y. (2020). Understanding Essential Factors in Influencing Technology-Supported Learning: A Model toward Blended Learning Success. *Journal of Information Technology Education*, 19, 490-510.

Zhang, J., Bakeman, M., Flaherty, P. T., Johnson, A., Schreihans, C., Addae, H. M., Phillips, A. (2020). Management Students' Perceptions of Online Teaching Quality. *E-Journal of Business Education & Scholarship of Teaching*, *14*(2).

Zilka, G. C., Cohen, R., Rahimi, I. D. (2018). Teacher presence and social presence in virtual and blended courses. *Journal of Information Technology Education: Research*, *17*, 103-126.