INVESTIGATION OF THE IMPLEMENTATION OF TECHNOLOGY TOOLS TO FACILITATE ONLINE INTERACTION

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Abstract: Research has shown that online interaction and technology, which has been used to facilitate interaction, affect the success of online learning (Downing, 2012; Harper, 2018; Keengwe et al., 2013; Moore, 1989; Saadatmand et al., 2017). This dissertation aimed to address how a group of exemplary instructors effectively implement technology to incorporate interaction and interactivity in online courses. Exemplary online instructors in this qualitative study served as models to assist instructors who are novices in online teaching. In this dissertation, the theories of interaction by Moore (1989) and Hillman et al. (1994) served as the foundation concepts for interaction and interactivity in online environments. The data collection process for this qualitative study included individual interviews, observations, and documents that helped describe the types of interaction in online learning and provide the answers to the research questions. The participants in this study were recruited from a group of instructors who were nominated for the 2020 Online Teaching Excellence Award at a comprehensive, doctoral granting university the South-Central region university in the United States. The study also applied the Teacher Response Model (TRM) of Technology Integration (Kopcha et al., 2020) to construct interview questions and analyze data collected to explore instructors' choice and implementation of technology in their online courses. This study contributed to the interaction theories by describing how exemplary instructors chose and used technology tools to facilitate four online interaction types, including learner-content, learner-instructor, learner-learner, and learner-interface. The findings demonstrated the practices of a group of exemplary online instructors who successfully implemented technology to enhance interaction and interactivity in their online courses. The data and discussion from this study could help those who support online instructors (e.g., instructional designers/specialists and technology staff) develop strategies and methods for professional development activities. The application of the TRM (Kopcha et al., 2020) in this study provided a thorough understanding of selecting and implementing technology which could serve as a foundation for a faculty professional development session.

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CHAPTER I

INTRODUCTION

Interactions in online environments are key issues that affect the success of online learning (Bawa, 2016). The U.S. Distance Learning Association confirms that "interaction is an integral component" in distance education (Holden & Westfall, 2007). Online interactions are categorized as interactions between learners and instructors, learners and learners, learners and contents (Moore, 1989), and learner and interface (Hillman et al., 1994). A number of research studies have examined online interactions and their importance in online learning (Downing, 2012; Harper, 2018; Keengwe et al., 2013; Moore, 1989; Saadatmand et al., 2017). Harper (2018) provided a critical analysis to evaluate the impact of technology on teacher-student interactions. The results showed that technology had become a communication tool to bring advantages and enhance teacher-student interactions in face-to-face and online settings. According to Harper (2018), technology has provided new spaces for discussions and improved the frequency, length, and effectiveness of communication between teachers and students.

Technology also involves the process of applying practical knowledge for a purpose (Spector, 2016). In the field of education, the purpose of implementing technology is to improve learning, instruction, and performance (Spector, 2016). Gentry (1995) reviewed the different versions of the meaning of educational technology from 1968 to 1977 and defined educational

technology as “the combination of instructional, learning, developmental, managerial, and other technologies as applied to the solution of educational problems” (p. 8). The Association for Educational Communication and Technology (AECT) provides the definition of educational technology as “the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources” (Januszewski & Molenda, 2008, p. 1) .

Technological advances in the 21st century have been developed and contributed significantly to the process of teaching and learning in an online environment, which is referred to as online learning or online education. Online learning provides opportunities for learners to access education in different ways in comparison with traditional face-to-face instruction. Online learning is accepted as one of the essential components of education to make learning more accessible (Allen & Seaman, 2016; Singh & Thurman, 2019). The evolution of the Internet and technology has transformed online learning positively during the past decades by giving instant access, massive quantities of information, and online digital materials for learners in various places and time zones (Li & Irby, 2008).

Online learning has grown steadily and rapidly through the decades (Allen & Seaman, 2016; Lederman, 2018b). The United States Department of Education’s National Center for Education Statistics (NCES) stated that over 6.6 million students enrolled in online education in the USA by Fall 2017 (Ginder et al., 2019). According to Saadatmand et al. (2017), the growth of online learning has changed in relation to pedagogical design, technology development, and learners’ role. For example, “the pedagogical design of courses delivered through learning management systems (LMS) differs from courses delivered via distributed environments (using social media and online tools)” (p.63). Online learning attracts students because this kind of education offers a wide range of benefits, such as accessibility, affordability, convenience, and flexibility (Lederman, 2018a). When the spread of

coronavirus disease 2019 (Covid-19) since late 2019 led to the closure of schools around the world, online learning gained attention as a possible way to meet the demands of this unique situation.

According to Ntlabathi et al. (2014), several new tools that support learning have been designed and recognized, such as Moodle, MySpace, Facebook, Twitter, cloud computing, and cloud-based learning management systems (LMS) from the year 2000 to 2014. Researchers have examined a variety of technology tools to assist interactions in online learning environments, such as LMS, course management system (CMS), e-mail, discussion boards and forums, presentation and conferencing tools, social media tools, and other interactive tools (Armstrong, 2011; Beldarrain, 2006; Dawley, 2007). These technology tools are used to increase online activities and support online interactions (Bayne, 2015; Salazar, 2010; Singh et al., 2010). Similarly, the findings from the research by Saadatmand et al. (2017) suggest that implementing appropriate technology, such as forums, e-mails, and blogs, into online courses can promote learner-content interaction.

Besides the technology's utility, the benefits of technology in facilitating online interactions have also been explored in many other research studies. For instance, Keengwe et al. (2013) focused on the relationship between social presence and interactions in online learning by surveying students and instructors from an undergraduate course. Garrison (2009) defined social presence as "the ability of participants to identify with the community (e.g., course of study), communicate purposefully in a trusting environment, and develop inter-personal relationships by way of projecting their individual personalities" (p. 352). Students who participated in the study by Keengwe et al. (2013) completed a group project to implement new technological systems (Blogs, Wiki, Google and smart boards) into their future classroom. The findings from this study indicate there is a need for online instructors to examine effective methods and designs to improve online interactions and collaborations. In another study, Kuo et al. (2014) confirmed the usefulness of a web-based video conferencing tool in synchronous interactions; however, the study did not fully address the impact or the role of that tool in facilitating online learner-instructor interactions. In a review of recent research studies, Harper

(2018) provides an important analysis to evaluate and determine that technology benefits learner-instructor interactions in online settings. The author indicated the need to conduct studies on how technology can facilitate creating and developing interactions between learners and instructors.

Despite the advantages of technology tools in online interactions, there are still some issues that make interactions in online courses difficult. One of the problems is the lack of participation/attendance in synchronous sessions (Banna et al., 2015). According to Banna et al. (2015), many students in their study who attended the assigned synchronous session were not fully involved in the session. In terms of creating interactions besides the scheduled online sessions, participants in this study also used a Facebook group for the first sessions. However, the authors mentioned that Facebook was not considered a useful tool for classwork since learners considered it as personal for social interactions. Another problem is the use of the Gradebook tool, which was studied by Laflen and Smith (2017). The study suggested that learners were not interested in achieving feedback on final papers, which showed a low level of interaction between learners and the instructor.

It is important to find out how to plan, design, develop, and integrate technology effectively to facilitate all types of online interactions, for example, between learners and their peers, and learners and instructors. Keeping the aforementioned overview in mind, the implementations and effects of technology tools, which have continuously changed over time, provide instructors and learners opportunities to address, support and solve practical needs, issues and problems in online interactions.

Research Problem Statement

The initial problem was from a pilot study conducted by the researcher in the spring of 2019. The pilot study investigated instructors who volunteered to participate in the Spring 2019 pilot for the new Canvas LMS at the same university where the current study took place. Participants (n=23) in

this pilot study responded to a survey questionnaire about the use of technology to facilitate online interaction. The findings of this pilot study showed that a number of participants (n=13) used only familiar tools, such as e-mail, PowerPoint, and discussion boards, to facilitate online interaction. Only a few of the participants (n=7) indicated that they used other technology tools (i.e., Flipgrid and social media) to facilitate interactions in their online courses. Interestingly, two of the participants stated that they did not use any technology for online interaction. It was inferred from the pilot study's findings that many instructors may be missing opportunities to take advantage of different tools to promote interaction in their online courses.

In addition, based on the researcher's experiences in assisting online instructors since 2018, it has been challenging for instructors to incorporate (1) interactivity into the design of their online courses and (2) interaction into the facilitation of their online courses. Many instructors who teach online for the first time have questions about how to achieve the same interaction and interactivity in an online environment as they do in traditional face-to-face courses.

Recently, many traditional face-to-face courses have moved online worldwide since Spring 2020 due to the COVID-19 pandemic (UNESCO, 2020). In addition to instructors who teach online voluntarily, there are now many reluctant instructors required to teach online because of the pandemic. These instructors have questions about many aspects of online teaching, such as how to change their teaching methods and manage their time when moving to teach online (Dhawan, 2020). In this situation, providing training and support for online instructors has been becoming more urgent.

The problem that this current study investigates is the limited understanding of how technology tools can be used to support interactivity and, therefore, how to provide guidance to online instructors. According to Bandura (2001), observing role models effectively allows people to expand their knowledge and skills rapidly" (p. 270). Individuals who are recognized as being particularly knowledgeable are considered exemplary (Edwards et al., 2011). The term "exemplary" is also

defined as “deserving of imitation because of excellence” (Merriam-Webster, n.d). Previous research studies (Baran & Correia, 2017; Baran et al., 2013; Edwards et al., 2011; Lewis & Abdul-Hamid, 2006) have examined common qualities of exemplary instructors in teaching online. For example, Baran and Correia (2017) discovered four major characteristics of exemplary online instructors, including learner knowledge, subject understanding, successful interaction with learners, and excellent course evaluation rates. For that reason, exemplary online instructors can serve as models to assist instructors who are novices in online teaching. Hence, this study explores the decisions and practices of a group of exemplary instructors to increase understanding of how they use technology to promote interaction and interactivity in their online courses. This current study can then establish a foundation for future research as well as professional development interventions.

Theoretical Framework

Moore (1989) used the terms interaction and interactivity interchangeably when referring to the context of online education. However, Wagner (1994, 1997) differentiated between interaction and interactivity. (Wagner, 1994) described interactions as “reciprocal events that require at least two objects and two actions. Interactions occur when these objects and events mutually influence one another” (p. 8). Interactivity, according to Wagner (1997), “appears to emerge from descriptions of technological capability for establishing connections from point to point (or from point to multiple points) in real time” (p. 20). It can be concluded that interaction emphasizes activities between people, whereas interactivity emphasizes technology’s features.

Moore (1989) talked about the difficulty of defining interaction because interaction is an “important term that carries so many meanings” (p. 1), and it is often misunderstood by educators. Interaction was described as “reciprocal events that require at least two objects and two actions. Interactions occur when these objects and events mutually influence one another” (Wagner, 1994, p. 8). Also, Rose (1999) described the concept of interaction in online education as “a fragmented,

inconsistent, and rather messy notion" (Rose, 1999, p. 48). Finally, a definition of interaction was provided by Thurmond (2003) as the following:

> The learner's engagement with the course content, other learners, the instructor, and the technological medium used in the course. True interactions with other learners, the instructor, and the technology results in a reciprocal exchange of information. The exchange of information is intended to enhance knowledge development in the learning environment (p. 4).

Based on the definition and distinction between interaction and interactivity, the study uses the following theories to investigate how exemplary instructors choose and use technology tools to facilitate online interaction:

- The theory of interaction by Moore (1989)
- The theory of learner-interface interaction by Hillman et al. (1994)

Moore (1989) discussed three important types of interactions in learning: learners and instructors (learner-instructor), learners and learners (learner-learner), and learners and course content (learner-content). Moore emphasized that it is crucial for educators to recognize the differences between the three types of interaction to maximize the success of applying appropriate instruction activities. The theory of interaction was developed further when Hillman et al. (1994) introduced the fourth type of interaction: learner-interface.

The important role of the types of interaction in online education has been verified in later studies. For example, Beldarrain (2008) compares five design frameworks for integrating interaction in distance learning. He highlights the importance of including the four types of interaction by Moore (1989) and Hillman et al. (1994) in all steps of designing and/or developing every instructional design framework. Also, the meta-analysis by Bernard et al. (2009) affirms that the learner-learner interaction, learner-instructor interaction, and learner-content interaction play crucial roles in the

success of online learning. Thus, in this study, the theories by Moore (1989) and Hillman et al. (1994) served as the foundation concepts for interaction and interactivity in online environments and were used to inform the data qualitative data analysis process.

Besides the theories of interaction, this study uses the Teacher Response Model (TRM) of Technology Integration introduced by Kopcha et al. (2020). The TRM was developed to illustrate K-12 teachers' choice and use of technology by describing "the relationship between a teacher's beliefs, knowledge, experience, and use of technology" (Kopcha et al., 2020, p. 736). Kopcha et al. (2020) stated that understanding the TRM framework via a teacher's perspective on their practices provided "a powerful lens for understanding in-the-moment decision making as well as decisions made by reflecting back on past action or planning for future action" (p. 744). Burggraaf (2020) and Dedmon (2020) recommended using the TRM to interpret technology integration decisions and assess the efficiency of digital tools in supporting learning objectives. Hence, this study applied the TRM to generate interview questions and analyze data collected to investigate instructors' choice and application of technology in their online courses.

Chapter Two, Literature Review, provides more detailed discussions of the theories.

Research Design

To explore exemplary online instructors' practices and experiences in using technology tools for interaction and interactivity, this study used qualitative methods to obtain participants' precise, descriptive information and perspectives (Patton, 2015). This study followed a case study design to investigate "a real-life, contemporary bounded system (a case) or multiple bounded systems (cases) over time, through detailed, in-depth data collection" (Creswell & Poth, 2016, p. 153). In this study, the case design was to examine participants' success stories in order to increase the understanding of what they do to promote interactivity in their online classes, how they do it, and why. The researcher collected qualitative data from instructors who are involved in online courses. The data collection

included individual interviews, observations, and documents that helped describe the types of interaction in online learning and provided the answers to the research questions. The study utilized the Teacher Response Model (TRM) of Technology Integration (Kopcha et al., 2020) to construct interview questions and analyzed data collected to explore instructors' choice and implementation of technology in their online courses. The TRM by Kopcha et al. (2020) is described in detail in Chapter Three, Methodology.

Research Questions

The purpose of this study is to address how a group of exemplary instructors effectively implement technology to incorporate interaction and interactivity in online courses. The study will explore the following research questions:

1. What technology tools do instructors choose and use to facilitate online interaction and interactivity?
2. Why do instructors choose to adopt technology tools to facilitate online interaction and interactivity?
3. How do instructors choose technology tools for online interaction?
4. How do instructors use technology tools for online interactivity?

Significance of the Study

The findings from this study will contribute to a better understanding of the practices of exemplary online instructors in order to support those who are new to online teaching. The study is useful to raise instructors' awareness of practices that can make online education engaging and interactive, both in the current pandemic era and into the future as online learning continues to be popular.

Scope of the Study

This dissertation only focuses on the implementation of technology tools for online interactions. It gathers perspectives from a group of exemplary instructors who have taught online at a public research university in the South-Central region of the United States. This study focuses on fully online courses and does not address courses taught in other formats, such as blended, hybrid, or hyflex environments. Therefore, the findings of this study will not be able to represent all other populations and locations.

Definitions of Terms

Online Learning. Online learning refers to courses that are delivered via the use of the Internet (Anderson, 2008).

Asynchronous. Learners participate in online learning activities at different times during the week (Ko & Rossen, 2017).

Synchronous. Learners participate in online learning activities at the same time (Ko & Rossen, 2017).

Learner-Instructor Interaction. This is an interaction between the learner and the instructor. Instructors deliver learning materials, support, and motivate learners (Moore, 1989).

Learner-Learner Interaction. This interaction occurs when learners share ideas or exchange information with each other about the course content (Moore, 1989).

Learner-Content Interaction. This form of interaction refers to the interaction between learners and course materials. This can include learners interacting with text, lecture, audiotape, videotape, and computer programs (Moore, 1989).

Learner-Interface Interaction. This type of interaction indicates the interaction between learners and technologies used to distribute instructions (Hillman et al., 1994).

Summary

This chapter provides a brief description related to the research topic, theoretical framework, definition of terms, importance, and scope of the study. The following chapter reviews the literature to discuss the current issues, including online interactions, technology tools, the influence of technology tools on online interactions, and the gap in the literature that led to the need for this study.

Organization of the Study

The purpose of this study was to address the implementation of technology to incorporate interaction and interactivity in online courses by a group of exemplary instructors. This dissertation includes five chapters. The information mentioned above is from Chapter One of this dissertation. Chapter Two reviews the literature to discuss the current issues, including online interactions, technology tools, and the implementation of technology tools for online interactions. Chapter Three provides detailed information on the research methods used in this study. Chapter Four describes the analysis and findings of the data collected through individual interviews. Chapter Five summarizes the findings of the analyzed data, the discussion, as well as the implications of this study.

CHAPTER II

LITERATURE REVIEW

This study investigates how a group of exemplary instructors chose and used technology effectively in online courses. In this chapter, the researcher reviewed and summarized the literature related to the present study. This review of literature begins by providing an overview of the Role of Interaction in online learning in higher education from recent studies. The following section examines Theories of Interaction by Moore (1989) and Hillman et al. (1994). Then, the review focuses on technology tools and their effectiveness in supporting interaction in online courses. The implementation of technology tools in online interaction is also discussed to present the strategies for choosing and using the tools.

The Role of Interaction in Online Learning

There are two primary types of online learning, asynchronous and synchronous, which are confirmed as effective methods to promote communication and interactions in online classes (Girard et al., 2007; Holden & Westfall, 2007; Li et al., 2009). Interaction in online learning has been found both in asynchronous and synchronous online learning forms (Holden & Westfall, 2007).

Asynchronous online learning occurs when participants use media (e.g., e-mail and discussion boards) to participate in an online course at various times (Hrastinski, 2008; Ko &

Rossen, 2017). Interaction in asynchronous online learning has numerous benefits, such as creating intensive learning environments, promoting meaningful discussions, constructing and expanding knowledge, and increasing learners' success (Alharbi, 2018; Comer & Lenaghan, 2013; Duncan et al., 2012; Galikyan & Admiraal, 2019; Jo et al., 2017; Jowallah, 2014). On the other hand, synchronous online learning is explained as the process when participants in an online course join activities at the same time with the help of media (e.g., chat and videoconferencing) (Hrastinski, 2008; Ko & Rossen, 2017). Synchronous interactions positively promote motivation and affect participation in online discussions (Hampel & Stickler, 2012; Hrastinski, 2008). Synchronous communication also increases interactions between learners and instructors by providing immediate feedback, improving brainstorming and decision-making skills, and increasing learners' attitudes towards and satisfaction with online learning (Chen et al., 2005; Huang & Hsiao, 2012; Martin et al., 2012; Park & Bonk, 2007; Salmon, 2003; Smyth, 2011).

Numerous studies have distinguished the differences between interaction in asynchronous and synchronous online learning. For example, when comparing synchronous and asynchronous interactions, Hrastinski (2008) stated that synchronous interaction better facilitates personal engagement by offering "increased psychological arousal, motivation, and convergence in meaning" (p. 505), while asynchronous interaction better increases cognitive participation by providing improved reflection and the opportunity to interpret information. Strang (2012) compared learner-learner interactions and performance between the asynchronous discussion forum and synchronous Skype discussion session. The results showed that learners received significantly higher grades when participating in the synchronous Skype discussion session. The differences in synchronous and asynchronous interaction were again described by Asterhan and Schwarz (2010). The researchers found that synchronous interactions were more accessible, leading to instant responses from the instructor or other learners. In contrast, the asynchronous interaction in online learning gave participants more time for thinking and reflecting.

In summary, many research studies have verified the important role of interaction in the success and satisfaction of online teaching and learning (Anderson, 2008; Downing, 2012; Harper, 2018; Hassenplug & Harnish, 1998; Keengwe et al., 2013; Kuo et al., 2014; Parker, 2020; Saadatmand et al., 2017). There are advantages to including both asynchronous and synchronous in online learning activities to improve interactions. The following review section discusses the theories of interaction in online learning used in this dissertation.

Theories of Interaction in Online Learning

Moore (1989) introduces and discusses the importance of the three types of interaction in online education. The types of interaction include learners and instructors (learner-instructor), learners and learners (learner-learner), and learners and course content (learner-content). Learner-instructor interaction is the interaction between the learner and the instructor. Instructors deliver learning materials, support, and motivate learners. Learner-learner interaction happens when learners interact with each other about the course content. Learner-content is the interaction between learners and course materials, such as text, documents, and images. According to Moore, educators need to distinguish these three types of interaction to "ensure maximum effectiveness of each type of interaction and ensure they provide the type of interaction that is most suitable for the various teaching tasks of different subject areas, and for learners at different stages of development" (p.5). Also, Bernard et al. (2009) concludes in their meta-analysis that increasing interaction with the learning content, with the instructor, or with other learners influences student learning positively.

Learner-Content Interaction

The first type of interaction is defined by Moore (1989) as the interaction between learners and course content or subject. According to Moore, this type of interaction is the defining educational characteristic for the reason that without it, education cannot be possible. He explains

that this type of interaction is “the process of intellectually interacting with content that results in changes in the learner’s understanding, the learner’s perspective, or the cognitive structures of the learner’s mind” (p. 2). In terms of interacting with content, learners can interact with various materials, such as texts, printed material, radio and T.V. programs, audiotape, videotape, and computer software (p. 2). The example of learner-content interaction at that period of time was considered “one-way communication with a subject expert” (p.2).

Learner-Instructor Interaction

Moore (1989) described the second type of interaction, learner-instructor, as the interaction between the learner and the instructor. According to Moore, this type of interaction was “regarded as essential by many educators, and highly desirable by many learners” (p. 2). The value of this type of interaction is to present content, encourage learners to study, and provide support for learners. Instructors are experts in the field of study, and they deliver learning materials, support and motivate learners, as well as “enhance and maintain the student’s interest” in the course content (p.2). Moore indicated that the instructor’s role in this type of interaction is to “organize evaluation to ascertain if learners are making progress and to help decide whether to change strategies” (p.3). The role of the learner in the learner-instructor interaction is to respond to the instructor’s presentation and communicate with the instructor. In order to make this type of interaction possible, instructors and learners can utilize two-way communication methods like correspondence, teleconference, and recorded audio or video presentations.

Learner-Learner Interaction

According to Moore (1989), this third form of interaction is “inter-learner interaction” which happens when one learner shares ideas or exchanges information with other learners about the course content. He added that the learner-learner interaction could be “alone or in group

settings, with or without the real-time presence of an instructor." He also emphasized the importance of this type of interaction as a learning resource.

In online learning, learners interact with each other via "peer group interaction by asynchronous e-mail and by synchronous computer 'chatting'" (Moore, 1989, p. 4). Moore mentions other methods to support this type of interaction as peer discussion, analysis in small groups, and teleconference. For example, two or more learners shared weekly presentations followed by peer discussion. Then, small groups analyzed and provided feedback and further discussion. Teleconference was another example that Moore (1989) indicated as an excellent method for learner-learner interaction. However, Moore (1989) also pointed out that the level of interaction between learners is not equal. With young learners, for instance, the activities that stimulate and motivate them will be facilitated by interaction between peer groups. On the other hand, for most adults and advanced learners, who aim to be self-motivated, the desire for interaction is not especially important.

Learner-Interface Interaction

Hillman et al. (1994) added learner-interface interaction as the fourth type of interaction. This type of interaction is relevant to include in this dissertation to explore the effectiveness of technology implemented by instructors in their online courses. Learner-interface interaction is the interaction between learners and technologies, or in other words, how learners manipulate tools to complete a learning activity. Hillman et al. (1994) stated that Learner-Interface Interaction is unique to online education and learners need to practice this type of interaction before they can effectively and successfully participate in the three types of interactions above. An example of this type of interaction provided by the authors was that if a learner wanted to retrieve messages from an answering machine, the learner needed to press or click the "Messages" button.

This type of interaction, according to Hillman et al. (1994), requires learners' ability to interact with technology in order to effectively engage in the online learning course. The learner-interface interaction is considered as a process that "requires the learner to operate from a paradigm that includes understanding not only the procedures of working with the interface but also the reason why these procedures obtain results" (p. 34). The researchers also recommended that it is necessary for learners to understand the basic communication protocol, which is relevant to the delivery system for transmitting and receiving information.

Studies and meta-analyses (e.g., Abrami et al., 2012; Anderson, 2003; Anderson & Garrison, 1998; Beldarrain, 2008; Bernard et al., 2009; Hillman et al., 1994) have discussed and expanded the concepts of interaction and interactivity in online settings using the theories of interaction developed by Moore (1989). In addition to Moore's (1989) three types of interaction, Anderson and Garrison (1998) provided descriptions of three additional types of interaction in online education: teacher-teacher interaction, teacher-content interaction, and content-content interaction. Anderson (2003) again discussed the six types of interaction and suggested that further research is needed to explore each of the types of interaction in virtual education. However, the scope of this study only focuses on the success stories of instructors' decision-making in the use of technology tools to facilitate online interaction and interactivity. For that reason, the three types of interaction discussed by Anderson and Garrison (1998) and Anderson (2003) will not be essential to investigate in this study.

Consequently, comparative analysis and meta-analysis results highlight the importance of the three types of interaction introduced by Moore (1989) in online learning environments (e.g., Beldarrain, 2008; Bernard et al., 2009). Beldarrain (2008) indicates that all the steps of designing/ developing in every design framework need to include both the three types of interaction by Moore (1989) and the additional type of interaction by Hillman et al. (1994). Moreover, Abrami et al. (2012) explores and confirms results from the meta-analysis by Bernard et al. (2009) that

learner-instructor, learner-learner, and learner-content interaction play major roles in online learning. Abrami et al. (2012) also use Moore's (1989) types of interaction as a basis to suggest approaches to foster online learning.

The theories of interaction by Moore (1989) and Hillman et al. (1994) have been used in various studies to explore interaction in online learning. For example, Su et al. (2005) examined instructors' perceptions of the importance of online interaction and which instructional techniques improve those interactions using the theory of interaction by Moore (1989). The findings indicated that instructors considered learner-instructor and learner-learner interactions as critical components of high-quality online programs. In another study, Mckenzie (2019) used Moore's (1989) interaction theory to investigate instructors' experiences of graduate student interaction in online courses. The study provided a description of different sorts of interaction in online courses based on the theory of interaction (Moore, 1989) and gave insight into the instructors' issues and successes with interaction in online graduate courses. Recently, Alzahrani and Althaqafi (2020) applied theories of interaction by Moore (1989) and Hillman et al. (1994) to explore the interaction of an online development program. According to the survey results, the limitation of interaction with trainers and other instructors caused the online courses to be less successful and engaging. The authors indicated that participants in this study understood the importance of online interaction between learners and learners, which was described by Moore (1989) as an enormously significant recourse for learning.

In summary, this dissertation study chose the theories of interaction by Moore (1989) and Hillman et al. (1994) to describe the interaction and interactivity in online courses. The researcher also used these theories to inform the data qualitative data analysis process. For instance, when analyzing data in this study, priori codes were developed based on the four types of interaction from these theories.

Technology Tools Support Online Interaction

Ally (2008) emphasizes that technology allows learners to access materials, digest, and customize information. Learners interact with content, other learners, and instructor during the process of transforming information received via technology. Yoon (2003) noted that "Technologies are implemented to create an interactive online environment to generate communication, presentations, simulations, and demonstrations" (p. 24). Researchers have examined a variety of technology tools that have been implemented to assist interactions in online learning environments, including Learning Management System (LMS), Course Management System (CMS), discussion boards and forums, presentation and conferencing tools, social media tools, and other interactive tools. It is necessary to group the tools under specific categories to explore the types of technology tools that have been used to facilitate online interactions,

Holden and Westfall (2007) categorized interactions into two main forms of online learning: asynchronous and synchronous. Hou and Wu (2011) and many other researchers indicated two types of digital tools that were used to facilitate interactions in online classes: asynchronous tools (i.e., online discussion forums) and synchronous tools (i.e., text-based I.M. tools and videoconferencing). In this study, technology tools that assist interactions in online learning are categorized under the two headings: Asynchronous Tools and Synchronous Tools.

Asynchronous Tools

Interactions provide flexibility for both instructors and learners to communicate with each other at various times and places during an online asynchronous session. Technology tools, which are used to simulate asynchronous interactions, are described in two forms: different times and same place (i.e., discussion boards and discussion forums) or different times and different places (i.e., e-mail and pre-recorded audio or video) (Yoon, 2003). There are four main formats of

asynchronous tools: e-mail, discussion boards/ discussion forums, blogs, and pre-recorded audio or video (Hou & Wu, 2011; Hrastinski, 2008; Singh et al., 2010; Yoon, 2003).

E-mail. According to Dawley (2007), e-mail has numerous advantages as an online tool, such as individual connections, user-friendliness, privacy, low cost, and accessibility. However, the author stated that using e-mails seems not to be highly recommended as a useful tool in facilitating asynchronous interactions in online learning environments. The findings of Shirani et al.'s (1999) study revealed that groups of students who used e-mails produced more inferential ideas; however, e-mails caused a low rate of intra-group communication due to the lack of nonverbal communication. In addition, most participants in a study by Wang (2011) stated that although e-mail was a convenient asynchronous tool, receiving too many e-mails from the instructor might make it difficult to find important information and pay attention.

Discussion Boards or Discussion Forums. The use of discussion boards or discussion forums is described as effective (Aloni & Harrington, 2018) and useful to implement for online asynchronous interactions (Calvani et al., 2010; Keengwe et al., 2013; Moreillon, 2015; Salazar, 2010; Singh et al., 2010; Swan et al., 2000). The threaded discussion is the most commonly used format in most online courses, in which instructors pose questions for students to answer, then students post their responses to each other's answers (Dawley, 2007; Rizopoulos & McCarthy, 2009; Thompson, 2006).

According to Schrire (2006), asynchronous online discussion forums are one of the most popular methods that lead to "deeper learning" and promote collaborations and interactions (p. 67). Asynchronous online discussions have been investigated to enhance learners' participation and learning and provide a comfortable learning environment for students (Comer & Lenaghan, 2013; Duncan et al., 2012; Jowallah, 2014). For example, Duncan et al. (2012) found that learners felt comfortable asking other learners for assistance with topics from a variety of evaluation

activities, and learners had flexible time for thinking and responding to asynchronous online tasks. Another role of asynchronous online discussions was to promote "knowledge construction by allowing participants to interact with one another" (An et al., 2009, p. 758)

The advantages of online asynchronous discussions are reviewed in many research studies. One of the benefits is the flexibility in time and place. Learners can choose their own time and place to respond to the discussion within the time frame that their instructor assigns (Rizopoulos & McCarthy, 2009; Swan et al., 2000; Thompson, 2006). Moreover, learners achieve more engagement and create more interactions with other learners by producing extended responses about the topic in the discussion (Rizopoulos & McCarthy, 2009; Swartzwelder et al., 2019). Also, another benefit of asynchronous discussions is that learners can achieve knowledge. For example, Swan et al. (2000) described the development of knowledge building in asynchronous online courses by stating that "in [an] active discussion, meanings are agreed upon, ideas negotiated, concepts evolved, knowledge constructed" (p. 380). In addition, when participating in discussion posts and comments, learners are allowed time to provide in-depth reflections (Dawley, 2007), which is explained as learners have

> enough time to read and reflect on their peers' or even instructors' comments and then respond to them, thus showing better processing or understanding of the information shared among learners. This implies that the delayed time in such asynchronous discussions allows for better and deep discussions that reflect learners' deep cognitive processing of what they discuss online (Alharbi, 2018, p. 511).

Besides the advantage of building knowledge, online discussions are also a helpful tool to engage learners in the course content. For instance, online discussions develop learners' writing skills by creating more opportunities for them to write brief "low-stakes" answers and increase learners' "exposure to peer responses" (Aloni & Harrington, 2018, p. 273). Studies have shown a positive attitude towards interaction through online discussion forums (e.g., Alharbi, 2018;

Çardak, 2016). Learner-learner, learner-instructor, and learner-learner content interactions have occurred during asynchronous activities via a discussion forum of an online course (Çardak, 2016). Among the three types of interaction, learner-instructor interaction was highlighted as an important factor "during knowledge construction processes since the expert of the subject is generally the instructor of the formal courses"(Çardak, 2016, p. 72). The results from Çardak's (2016) study showed that learners expressed their engagement with the discussion topics rather than interacting with other learners. The interaction between learners in this study was at a moderate stage which was explained as "most of the learners did not know each other before the course" (Çardak, 2016, p. 71). The learner-learner interaction in this study was not at the higher stage, even when the instructor kept reminding learners of the significance of responding to comments from other learners. Similarly, Alharbi (2018) collected and analyzed 1702 comments from 20 participants to examine learner-learner interaction in asynchronous discussions. The findings showed that the learners engaged in both task-oriented interactions (i.e., content, grammar, vocabulary, and punctuations) and non-task-oriented interactions (i.e., task management and socialization). Participants in this study expressed their positive experiences towards interacting with their peers and their instructor during asynchronous discussions, which assisted them in studying and communicating in English effectively.

Despite the above benefits, a number of issues have been found in text-based asynchronous discussions. Aloni and Harrington (2018) listed low participation and engagement in online discussions as one of the most significant issues. Another problem that affected learners' responses was "poor discussion board management" (p. 274). Learners felt disconnected or were not recognized by the instructor and other learners, which led to learners' difficulties in expressing their feelings. For that reason, there have been less meaningful and effective interactions in online discussions (Aloni & Harrington, 2018). As reported by participants in the study by Vonderwell (2003), a delay factor can affect students' learning and interaction in

asynchronous discussions. Asynchronous discussions in online courses have been identified as "a ubiquitous element in online learning courses" (Thompson, 2006, p. 20) and the most popular and generally accepted instructional technique (Jo et al., 2017).

Blogs. Blogs are also considered as online tools for asynchronous discussions (Clarke & Kinne, 2012; Singh et al., 2010). Instructors can ask students to create their blogs through an LMS (i.e., Canvas, Blackboard), CMS, or blogging platforms (i.e., WordPress, Blogger, Tumblr). Research by (Halic et al., 2010) investigated students' comprehension of blog effectiveness that supported their learning through a survey study. The results indicated that blogs had a positive effect on student learning. Almost all the participants agreed that blogging provided them opportunities to reflect on their knowledge as it relates to their lessons. Students were also willing to share information with the class that they found outside of the course. The authors gave a brief conclusion that educators should consider incorporating blogs into their teaching because this technological tool increased the interaction between teacher-student, student-student, and cognitive engagement.

Clarke and Kinne (2012) conducted a mixed-method study to compare two models of interaction in asynchronous online learning: discussion boards and blogs. The results showed that students who participated in discussion boards had a higher portion of academic responses. In contrast, students who used blogs produced more informal comments, such as "sharing parts of their personal lives through photos, videos, and personal comments" (p. 7). Because of informal responses, the student's engagement in the blog-based discussions was higher than those in the discussion boards, which increased the level of learner-learner, learner-instructor, and learner-content interaction.

Pre-recorded Audio or Video. Pre-recorded audio (audio-based) and pre-recorded video (video-based) have received attention as asynchronous formats in online learning (Do & Asino, 2019; Oh & Kim, 2016). The results of the study by Oh and Kim (2016) showed that participants

demonstrated higher levels of thinking skills while using audio-based discussions. Moreover, the participants in this study expressed their positive opinions and satisfaction with the audio-based asynchronous discussions. Video-based discussions are considered a more dynamic and interactive format to promote learner-learner and learner-instructor interactions (Swartzwelder et al., 2019). VoiceThread and YouTube are examples of video-based asynchronous technology tools in a study by Borup et al. (2012). The results show that video-based discussions assisted interaction between learners and the instructor. According to Johnson and Lock (2018), video discussions in online learning foster higher-order thinking in enhancing interaction and engagement. In addition, Clark et al. (2015) captured the effectiveness of posting videos to discuss assigned topics in asynchronous online sessions. The findings of their study showed that by using videos, students felt connected with other students, and students "experienced lower feelings of isolation" (p. 60). Although the findings indicated that the use of video-based discussions contributed to overall students' satisfactory interactions and course participation, two students in this study felt uncomfortable producing videos to post in the discussions.

Synchronous Tools

According to Park and Bonk (2007), the synchronous interaction in online discussions provided substantial advantages to the instructors and learners, such as promoting more engaging and constructive participation during the discussion. A number of synchronous tools have been listed in studies, including chat rooms, instant messaging (e.g., Instant Messenger), web conferencing, and audio/video conferencing, Elluminate, Blackboard Collaborate, WebCT Chat, and Skype (Huang & Hsiao, 2012; Martin et al., 2017). The authors indicated that the synchronous technology tools benefit both instructors and learners in enhancing interaction and increasing achievement. Yoon (2003) describes "a real-time text chat, audio-or video conferencing" as technologies that are used in different places but at the same time. In this study,

instant messaging and conferencing tools are the main categories of synchronous tools in online courses.

Instant Messaging. Hou and Wu (2011) carried out a case study to explore learners' interaction in synchronous discussions. Participants in this study used an online synchronous text-based instant messaging (I.M.) tool to discuss with each other about tasks and ideas to complete the task. The findings of this study showed that real-time discussions brought benefits to learners by increasing their decision-making in completing the task. Another tool that can be listed in this category is Conversational Virtual Agent, often known as a chatbot system, which is computer software that uses natural language to communicate with users and has been implemented in numerous online interactions between a user and software (Shawar & Atwell, 2007). Overall, the quality of synchronous communication between learners and a virtual agent significantly and positively affected learners' achievements, performances, and satisfaction in an online course (Shawar & Atwell, 2007).

Conferencing tools. Conferencing tools include audio conferencing, video conferencing, and web conferencing (e.g., Hampel & Stickler, 2012; Li & Irby, 2008). Videoconferencing is one of the popular tools that support interactions in online courses (Hampel & Stickler, 2012). Zoom is an example of a popular videoconference tool. Especially during the Covid-19 Pandemic, it has been widely used by colleges, universities, agencies, etc. (Gordon, 2020; Kohnke & Moorhouse, 2020; Li et al., 2021). According to (Gordon, 2020), instructors use Zoom in synchronous sessions to provide students with multimedia content, such as images, videos, drawings, and charts. Zoom also helps promote interaction in an online course (Gordon, 2020; Li et al., 2021).

FlashMeeting is another videoconferencing tool containing multimedia functions, such as audio, text chat, video, and images, and was necessary "for real real-time communication and

interaction in the course as well as keeping up student motivation and community building" (Hampel & Stickler, 2012, p. 122). Moreover, Singh et al. (2010) analyzed various kinds of technology tools used in online education in general and in online interactions specifically. Some of the tools mentioned in their study are Wimba, WebEx, DimDum, and Adobe Connect, which are classified as Web Conferencing Systems. Web conferencing was used to facilitate online synchronous learner-instructor interaction in a study by Li (2016). The findings in this study indicated a high level of interactions between learners and the instructor. Other technology tools, such as Interwise (Kuo et al., 2014), Google Hangouts and Big Blue Button (Knapp, 2018), and Padlet and Prezi (Saadatmandet al., 2 17) were studied as the use of presentation and conferencing tools in online interactions. For example, Interwise, a web conferencing tool, includes features (i.e., displaying PowerPoint Slides, videos, and images) that allow learner-learner and learner-instructor interactions (Kuo et al., 2014). However, Kuo et al. (2014) only identified the preference and satisfaction of using the web conferencing tool, and they did not indicate how the synchronous tool impacted the interactions in online courses in their study.

Hampel and Stickler (2012) carried out a qualitative study to explore the use of a video conferencing tool to support interactions in online synchronous activities. The authors found that synchronous activities provided opportunities for students to communicate and interact in real-time, which motivated students in learning and helped build a learning community. While using the tool, participants did not only interact with each other (learner-learner interaction and learner-instructor interaction), but also interacted with the course content (learner-content interaction) and the tool (learner-interface interaction).

Research shows that the use of synchronous technologies contributes to learners' satisfaction and participation in an online course (Skylar, 2009), allows learners the flexibility to interact with their classmates and their instructor (Smyth, 2011), and improves oral and visual interaction (Wang, 2004). For instance, Wang (2004) described the use of the video conferencing

tool NetMeeting to support verbal and visual interaction in online learning. The study mentioned that all features (i.e., file sharing, video, chat, icons, whiteboard) supported learners' interactions with the instructor effectively and enhanced interactions between learners and the interface. Another benefit of synchronous sessions was discussed by Banna et al. (2015) as "the students who were able to attend the live sessions perceived the extra interaction and discussion with peers and the instructor to be beneficial in terms of participation and learning" (p. 7).

Besides the above-mentioned tools, there are a number of other technology tools that can be used in both asynchronous and synchronous to facilitate online interaction. For example, Google Docs is a free web-based tool that provides opportunities for interaction in online courses (Lee & Abdul Rabu, 2021; Spaeth & Black, 2012), and instructors can create effective synchronous and asynchronous activities (Roseth et al., 2013). Furthermore, LMS and CMS are the most commonly used in higher education to deliver online courses and support online interactions (Banna et al., 2015; Knapp, 2018; Laflen & Smith, 2017; Pardo et al., 2018; Saadatmand et al., 2017; Salazar, 2010). A number of features in the LMS and CMS are designed to facilitate interactions in both online asynchronous and synchronous activities. For example, Canvas LMS provides announcements, e-mail, chat, conferences, discussions, and other third-party apps. With such features, Canvas LMS enables the instructor to create interactive environments.

In summary, there are several ways to categorize technology tools used to support online interaction. What is known in this section is that technology plays an important role in both asynchronous and synchronous interaction. Most of the technology tools used in the above studies have contributed to learners' performance and achievement. Additionally, the technology tools have promoted effective interaction in online learning. The implementation of technology tools in the following section provides information on how instructors chose and used technology in their online courses as described in published literature.

The Implementation of Technology Tools

According to Paul and Cochran (2013), learners expect that their experiences with technology relating to smartphones, social networking, and personal computers may be used in online programs. Learners also expect "applications to work seamlessly, have richness and clarity, be simple to use, and at times fun" (p. 59). For those reasons, online instructors play various roles (e.g., facilitator and course designer) in the success of integrating technology into an online course (Martin et al., 2019). There are many attributes of technology tools that influence the ways instructors choose and use technology to facilitate online interaction and interactivity in online learning. Firstly, technology tools provide resources for connecting learners and learners, learners and instructors, and learners and course content. Guo et al. (2018) discussed the use of e-mail and social media platforms as below.

> E-mails, including e-mails in the course management site and official school e-mail, have become a preferred communication method for questions and answers. Social media sites, such as Facebook, could be a supplemental communication method to push out information to students since students use it frequently (p. 36).

The study by Mooney et al. (2014) is an example of using technology tools to foster interaction in online learning. Mooney et al. (2014) examine factors to increase students' interaction in online asynchronous threaded discussion posting. Forty-nine students were asked to complete two different models for asynchronous discussions during one semester: the suspense model and the conventional model. The instructor utilized the suspense model by using multiple audio-visual media (i.e., audio and clips) to provide information for the discussion exercise. After finishing the first model, students were changed to the second model, the conventional model, in which students discussed the exercise via a scenario. The researchers stated that the aims of the suspense model were to facilitate the involvement and interaction of students in a group and to distribute instructional material in a new way to encourage students' engagement better. The

findings showed that the interaction level of students was higher in the suspense model than in the conventional model during the asynchronous discussion board. Participants in this study also expressed their preference for the suspense model to enhance social interactions and promote greater interactivity within the learning environment. Moreover, technology tools enhance access to materials, feedback, reflections, and discussions. For example, Paul and Cochran (2013) indicated that technology tools helped the learner and the instructor "overcome the limitations to communication found in many courses" (p. 50). Online collaborative and communication tools are essential for facilitating and enhancing learner-learner interaction and learner-instructor interaction (Hernández-Sellés et al., 2019; Moreillon, 2015).

Secondly, technology tools provide "authentic forms of interaction" (Martin et al., 2012, p. 250) and promote real-time interactions (Singh et al., 2010). For instance, Singh et al. (2010) reviewed web-based simulation tools and indicated that the use of these interactive tools provided learners opportunities to achieve "real-life practical experience" (p. 307). In addition, Moreillon (2015) used ApprenNet to increase online interactivity by asking learners to complete a video activity during a synchronous session. During the session, learners watched one or two-minute videos, reviewed videos with peers, observed feedback from an expert, and analyzed feedback. The use of ApprenNet, according to Moreillon (2015), provided "hands-on" activities that would help increase interactivity in the online environment.

Thirdly, technology tools promote online interaction via various kinds of visualizations or illustrations via photos, audio, and videos. For instance, using emotion icons as visuals in online environments enhances learners' motivation and experiences (Kuo et al., 2014). Similarly, Swan et al. (2000) stated that when the course interface became user-friendly, students could engage in navigating the course without any problems with technology adaptation. Applying multiple interaction techniques and tools (i.e., audio, text chat) benefits learners; for example, simple to

use the virtual classroom interface, which "facilitated frequent interaction among the students" (Martin et al., 2012, p. 247).

Fourthly, the use of technology tools can influence learners' performance and engagement (Blasco-Arcas et al., 2013; Guo et al., 2018; Swan et al., 2000; Yang, 2011). The findings from Blasco-Arcas et al.'s (2013) study have shown that using a student response system, named Clickers, in online interactive activities improved learners' levels of interactions with their peers and their teacher, levels of engagement, and levels of learning performance. Guo et al.'s (2018) study investigated the use of social media to facilitate learner-instructor interaction in online education. The finding of this study demonstrated that implementing social media (i.e., Facebook) in an online course definitely assisted learner-instructor interaction, lowered the rate of failure, and enhanced learners' academic achievement. Yang (2011) collected data from students' pre and post-tests and a questionnaire to evaluate students' engagement in synchronous online learning. By using E-meeting, participants in this study interacted with the instructor, the teaching assistants, and other learners. The results revealed that students had positive perceptions of engagement and participation in online synchronous activities in which they had better interactions with their instructor.

Many other factors affect the implementation of technology tools in online courses, such as accessibility (Martin et al., 2019), effectiveness (Bower, 2011; Martin et al., 2012; Wang, 2004), free or low-cost (Wang, 2004), flexibility (Chen et al., 2005; Wang, 2011), and availability of technical support (Baran, 2011; Yoon, 2003). Schulz et al. (2015) indicate three main factors that influence the implementation of technology tools in online courses, including "human elements (i.e., abilities, attitudes, beliefs, and confidence); intrinsic elements (i.e., satisfaction, interest level, excitement, and enjoyment); tools' requirements (i.e., usability, interaction level, monitor performance, specialization, flexibility, and learning needs)" (p. 66).

Despite the benefits of technology tools for promoting online interactions, there are still some issues that make interactions in online courses harder. Banna et al. (2015) mentioned the decrease in participation or attendance in the synchronous sessions was an issue. Many participants in their study stated that they could not attend the live sessions because of conflicting schedules. Instead, they chose to view the recording after the synchronous session, which did not involve any engagement or interactions with other students as in the live conference. Another problem is the technical difficulties, such as making connections (Wang, 2004), using a microphone (Martin et al., 2012), displaying information, operating the technology, and managing interactions (Bower, 2011). Wang (2004) indicated that no or slow Internet connection prevented real-time conferences and decreased interactions. According to Martin et al. (2012), the microphone was the most common and effective tool used during synchronous sessions; however, difficulties in using the microphone affected learner-learner and learner-instructor interactions. Bower (2011) described a number of technical problems, that might be misunderstood or misused by instructors or facilitators (i.e., how learners interact with each other while doing a screencast). The difficulties, according to Bower (2011), are explained as inadequate training in operating the tool (i.e., how to configure hardware and software).

Application of a K-12 Model to Higher Education Settings

Relating to the implementation of technology, Kopcha et al. (2020) introduced the TRM to illustrate K-12 teachers' choice and use of technology. Figure 1 shows how the TRM describes "the relationship between a teacher's beliefs, knowledge, experience, and use of technology" (Kopcha et al., 2020, p. 736). The TRM, which is described in Figure 1, starts with identifying reasons for using technology to determine the teacher's intention of selecting technology. In this step, based on the teacher's beliefs, understanding, and practice, the teacher finds answers to the question: "What is best for me and my students, and how can technology help?" (p. 736). The next step in the TRM is the process of evaluating and identifying the final choice of technology.

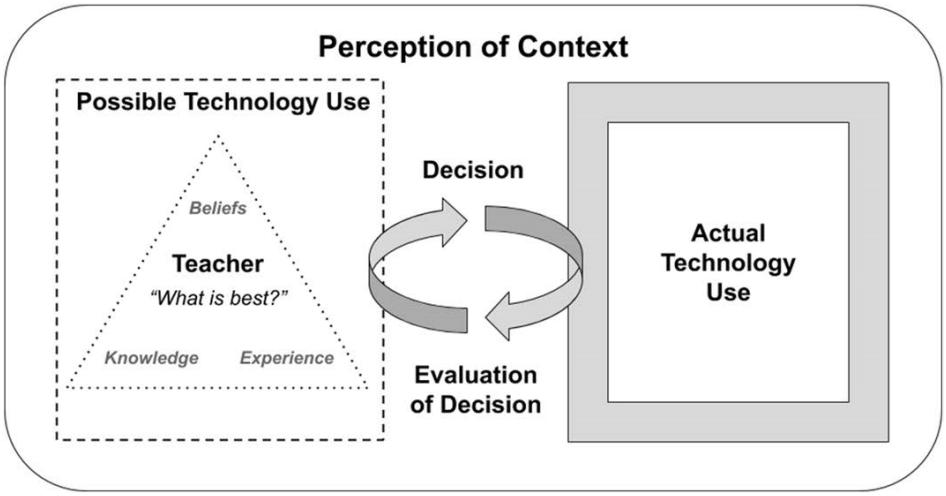
In other words, this step relates to the decision-making process. The TRM informs the implementation of technology in the last step. In this step, teachers reflect on their evaluation after using technology and discuss their technology decision in the future.

Kopcha et al. (2020) illustrated the TRM framework by providing an example of how an English teacher in a high school chose and used technology to engage students. The teacher decided to redesign a digital escape room task because his students needed essential grammar knowledge and skills. The teacher noticed that his students went off-task at the first implementation of the digital escape room activity. In the process of decision-making, the teacher used his opinions, knowledge, and practice to identify the best way to get students back on track and started remediation by pausing the digital escape room. The teacher also evaluated his choice and considered alternatives to remediate the activity. The teacher decided to take two days to teach necessary grammar before resuming the digital escape room. The better results of redesigning the activity led the teacher to consider the future application of technology.

According to Kopcha et al. (2020), understanding the TRM framework via a teacher's perspective on their practices would provide "a powerful lens for understanding in-the-moment decision making as well as decisions made by reflecting back on past action or planning for future action" (p. 744). Researchers recommend using the TRM to interpret technology integration decisions (Burggraaf, 2020) and assess the efficiency of digital tools in supporting learning objectives (Dedmon, 2020). However, no research study has been conducted using the TRM framework to analyze the decision-making process of integrating technology in education.

Figure 1

The Teacher Response Model (TRM) of Technology Integration (Kopcha et al., 2020)



Note: Reprinted by permission from Springer Nature (Kopcha et al., 2020)

This TRM framework helps explain teachers' processes for selecting and using technology and was developed to explore and illustrate K-12 teachers' decision-making. The current study is the first known example where the TRM framework is applied in both K-12 and higher education and can therefore contribute to the development of the TRM framework by expanding the contexts in which it can be applied. The TRM was used in this study as a guide to create interview questions and analyze data collected thematically to examine instructors' decisions and practices in using technology tools for online interaction and interactivity.

Need for the Study

Research has shown that learners can enjoy participating in an extensively interactive online environment through the use of technology tools, such as threaded discussions, e-mail, and chat rooms (Francis et al., 2010). Although studies have investigated the selection and implementation of online learning tools (Acquaro, 2017; Mckenzie, 2019), there has been little

research on instructors' selection and implementation of technology tools specifically to foster online interaction. For example, a recent study by Mckenzie (2019) investigates instructors' experiences with learner interaction in online graduate courses at one college. This study mainly focuses on providing understandings of instructors' success and difficulties among three types of interaction (i.e., learner-content, learner-instructor, and learner-learner) at the graduate level. Several participants in this study mentioned the choice and usage of some technology tools (e.g., Google Docs, Flipgrid, and Zoom); however, they did not indicate how the technology facilitated online interaction. In addition, because of the COVID-19 pandemic, a large number of face-to-face courses have transferred to online versions globally since Spring 2020 (UNESCO, 2020). This urgent situation has resulted in difficulties related to online teaching (e.g., teaching methodologies and time management) from instructors who are new to online education (Dhawan, 2020). Therefore, it is important to investigate further the implementation of technology to facilitate interaction in online learning.

The purpose of this study was to explore the decisions and practices of a group of exemplary instructors to increase understanding of how they use technology to promote interaction and interactivity in their online courses. This current study can be a foundation for future research as well as professional development activities. The following are research questions explored in this study.

1. What technology tools do instructors choose and use to facilitate online interaction and interactivity?
2. Why do instructors choose to adopt technology tools to facilitate online interaction and interactivity?
3. How do instructors choose technology tools for online interaction?
4. How do instructors use technology tools for online interactivity?

Summary

This literature review examined the definitions of interaction, the role and the importance of four types of interaction by Moore (1989) and Hillman et al. (1994), the technology tools used to support interaction, the implementation of technology tools in online interaction, and the adaption of the TRM (Kopcha et al., 2020) to investigate how instructors choose and use technology tools to facilitate online interaction. Based on the review, a need to conduct this study was identified. Chapter Three will discuss the methods of this dissertation.

CHAPTER III

METHODOLOGY

This study focused on the successful implementation of technology to incorporate interaction and interactivity in online courses by a group of exemplary instructors. This study explored participants' practices and experiences in using technology tools in online courses. Choosing an effective research design is the key to the success of a project since it determines the quality of the conclusions that will be drawn from the findings of the research ((Bordens & Abbott, 2002). Qualitative research is an appropriate choice for this study since it studies "inside the phenomenon of interest to get detailed, descriptive data and perceptions" (Patton, 2015, p. 6).

This qualitative research used a constructivist approach to understand and explain the situations and participants' experiences. According to Crotty (1998), constructivism is considered as an epistemology which "is a way of understanding and explaining how we know what we know" (p. 3). The epistemological stance provides access for the researcher to collect rich data from the participants to understand participants' perceptions. In addition, the researcher used the interpretivist approach as a theoretical perspective for this study. Crotty (1998) defined interpretivism as a perspective that looks for "culturally derived and historically situated interpretations of the social life-world" (p. 67). Interpretivism describes human beings and examines cultural and historical viewpoints, which help researchers understand and interpret

social life (Crotty, 1998). To carry out this study, the researcher gathered data from participants who successfully integrated technology tools to facilitate interaction and interactivity into their online courses to interpret their practices and experiences in online teaching.

Case Study Design

A case study is an in-depth investigation of an event (or multiple events) that "exhibits (or exhibit) the operation of some identified general theoretical principles" (Mitchell, 1983, p. 192). According to Yin (2014) a case study "comprises an all-encompassing method-covering the logic of design, data collection techniques, and specific approaches to data analysis" (p. 17). Case study also illustrates the unit of research "in depth and detail, holistically, and in context" (Patton, 2015, p. 121). In addition, case study is the most appropriate strategy when a study seeks answers to "how" and "why" questions, and the study addresses contemporary phenomena in a real-life setting (Yin, 2014). Creswell and Poth (2016) defined case study in more details as

> a qualitative approach in which the investigator explores a real-life, contemporary bounded system (a case) or multiple bounded systems (cases) over time, through detailed, in-depth data collection involving multiple sources of information (e.g., observations, interviews, audiovisual material, and documents and reports), and reports a case description and case themes. The unit of analysis in the case study might be multiple cases (a multisite study) or a single case (a within-site study) (p. 153).

The researcher selected a multiple case study approach for this study because data collected and analyzed from a group of exemplary online instructors is considered as literal replications (predicting similar findings) including similar answers to the "how" and "why" research questions (Yin, 2014). Moreover, Stake (2006) clarified the role of single cases in multiple case study as "the single case is of interest because it belongs to a particular collection of cases. The individual cases share a common characteristic or condition. The cases in the collection are somehow categorically bound together. They may be members of a group or

examples of a phenomenon" (pp. 4 – 6). Patton (2015) introduced the instrumental-use multicase purposeful sampling as a design "to select multiple cases of a phenomenon so as to understand the phenomenon and, in applied multicase studies, generate generalizable findings that can be used to inform changes in practices, programs, and policies" (p. 446).

This study examined multiple cases following the instrumental use sampling design (Patton, 2015) to investigate participants' success stories in implementing technology to facilitate interactivity and interaction. Patton (2015) also highlighted the use of utilization-focused sampling approach as one of the two typical types of the instrumental sample design. Utilization-focused sampling involves selecting cases that have relevance to the issues and decisions that impacted a certain group, to explore in-depth case information in order to fully understand individual case characteristics and cross-case relationships (Patton, 2015). The in-depth information, according to Patton (2015), supported findings about "causal factors and recommendations about actions to be taken beyond the cases studied" (p. 447). The findings of this study contributed to the understanding of why and how a group of exemplary instructors choose technology tools in their online courses for interaction and interactivity. In addition, the study provided recommendations in applying the TRM (Kopcha et al., 2020) to explore the process of choosing and using technology facilitate online interaction.

Research Settings and Study Sample

The participants in this study were seven online instructors who have taught at least one online course at a research university in the south-central United States. The university has nine colleges, including Agriculture, Art and Sciences, Education, Engineering, Architecture and Technology, Global Studies, Honors College, Schools of Business, University College, and Veterinary Health Sciences. A variety of online courses and programs are offered in this university. The university has centers to support online education, such as the Teaching and

Learning Institute that provides online teaching resources and instructional technology assistance, and the Online Centers that offer online degrees and certificates. Due to COVID-19, the entire university changed into online learning in the mid-term of Spring 2020. This situation resulted in all instructors transforming their traditional face-to-face courses into online versions.

In this study, the researcher invited online instructors who successfully integrated technology tools into their course(s) for promoting online interaction and interactivity. The purposes of selecting these participants were (1) all participants had experiences in online settings, and (2) all participants were involved directly in incorporating the technology to facilitate online interaction and interactivity. These criteria for selecting participants provided the strongest information for this study to understand how online instructors choose and use technology tools in their online course(s).

To identify the participants, the researcher searched for contact information from the list of administrators, online program coordinators, instructional designers/specialists from each college through the university website. After receiving IRB approval, the researcher sent e-mails to them to introduce the study and request the contact information for exemplary online instructors as potential participants who met the criteria for this study. Through multiple contacts, the researcher received a list of ten faculty members who were nominated for the 2020 Excellence Award in Teaching Online across the university. According to the guideline for the nomination (Ormsbee, 2020), the criteria for the award included:

- Demonstration of a high level of instruction
- Use of effective and innovative online teaching practices that result in student engagement, student satisfaction, and effectiveness in achieving desired learning outcomes
- Demonstration of a commitment to fostering the academic success of online students
- Use of effective methods of assessment of student learning

- Frequency of online teaching activity

The practices of awarding instructors who successfully teach online in higher education have been addressed recently (Bailey, 2008; Martin et al., 2019; Pelz, 2010). In addition, the criteria and process for the Excellence in Teaching Online were comparable to those used to identify an award-winning instructor in such research studies. For instance, Bailey (2008) described that the award required online teaching competencies and followed a nomination procedure by a board of administrators. The participants who were nominated for the Excellence Award in Teaching Online at the South-Central university in 2020 received letters from students and faculty colleagues describing how they met the award criteria.

The researcher sent an invitation by e-mail with a Consent Information Form to the ten potential participants and invited them to participate in this study. Then, the researcher contacted seven respondents who agreed to participate by e-mail to schedule the date and time for the interview. Each of online instructors who agreed to participate was represented as a case study for the purpose of this study. This multiple case study included seven cases. The researcher also asked the participants to show the course(s) in which they successfully integrated technologies for observing and artifacts.

Research Instrument

Patton (2015) stated that interviews are powerful instruments to uncover people's perceptions, experiences, feelings, and opinions. Interviews help gather "high-quality data" to understand "what is inside people" (Patton, 2015, p. 495 - 496). In this study, the researcher conducted semi-structured interviews with instructors who satisfied the interview requirements and volunteered to participate in the interview. The researcher prepared a protocol of interview questions, including open-ended questions for interviewees to use their own words to answer. The interview questions were developed, followed by two main sections: background information and

experiences in implementing technology tools to integrate interaction and interactivity in online courses. The researcher used a demographic questionnaire to gather participants' background information, such as age, gender, race, nationality, current position, and years of online teaching experiences. To develop questions to ask participants' experiences in incorporating technology to foster interaction in online courses, the researcher used the interaction theories by Moore (1989) and Hillman et al. (1994). Interview questions focused on what type of interaction, what type of technology was used to facilitate the interaction, and why it was important in online courses. For example, in the interview question 1, the researcher asked participants to talk about how they chose technology to facilitate instructor-learner interaction. For other interview questions that referred to types of interaction introduced by Moore (1989) and Hillman et al. (1994), see Appendix B.

Besides the theories of interaction, the researcher also used the study by Kopcha et al. (2020) to develop interview questions relating to the instructor's decision-making process to implement technology in an online course. For example, to identify instructor's reasons for choosing and using technology, and actual implementation of technology to facilitate online interaction, the researcher developed the following sub-questions in the first interview question:

- What were you thinking about when you made that decision?
- Once you'd chosen the technology, how did you use it?
- Were you satisfied with the implementation of technology tools on the levels of interacting with your students? Why or why not?

Background Information from Pilot Study

A pilot study was conducted in Spring 2019 (IRB Application Number ED-19-40 – see Appendix A) to address how the use of technology tools facilitates interactions in online education in higher education. The data was collected via an online survey, including both

qualitative and quantitative questions. Participants who completed the survey were 23 instructors who volunteered to participate in the Spring 2019 pilot rollout for the new Canvas LMS at the same university where the current study took place. Among 23 participants, nine of them taught fully online courses, 11 participants taught primarily face-to-face courses, and three out of 23 taught hybrid or blended courses.

The findings provided an insight into how instructors used technology tools to facilitate interaction. In this pilot study, participants were asked to show what type of technology tools they used for additional activities to enhance interaction in their courses. The findings showed that a total of 14 out of 23 (61%) chose to use technology tools that they were already familiar with, such as e-mails, PowerPoints, and discussion boards, to facilitate interaction. Whereas seven out of 23 (30%) used a number of different technologies to facilitate interaction. In addition, two out of 23 (9%) indicated that they did not use any technology for the purpose of supporting interaction in their course. It was inferred that many of the participants might be missing opportunities to use a variety of technology tools to enhance interaction.

The pilot study was beneficial to this study by providing initial views of technology tools that the instructors used to facilitate online interaction. For example, technology tools for learner-instructor interaction were Twitter, Instagram, GroupMe, Kahoot, Zoom, Flipgrid, and Canvas discussion boards. In terms of learner-content interaction, instructors listed the following technology tools that they used in their course: Canvas LMS, videos, websites, Twitter, Instagram, YouTube, Arc, Interview Stream, and Flipgrid. Only a few of technology tools, such as discussion board, video discussion, and Google Doc, were implemented to facilitate learner-learner interaction. The implementation of such technology tools was used as a guide for reviewing existing literature in this study. Another benefit of the pilot study was to provide potential ideas that can be examined further in this study. How instructors choose and use

technology tools to facilitate interactions in their online course(s) is an example of the ideas that were examined in the current study.

Data Collection

The data collection process for this study included individual interviews, observations, and screenshots.

Individual Interviews

Based on the university's guidelines for COVID-19 safety, the researcher conducted virtual interviews synchronously in real-time via ZOOM with all participants. researcher selected the traditional social science interviewing approach as Patton (2015) indicated this approach "emphasizes standardized questions and consistency across interviewers and interviewees" (p. 636). The interview protocol (Appendix B) was used to gather more information to provide an in-depth explanation for the research questions. The researcher revised and practiced asking questions before each interview, and the researcher tried to anticipate unexpected situations and prepare some possible solutions. For example, the researcher used a laptop for all ZOOM interviews, but the researcher also prepared a phone with a high-speed internet plan in case the Wi-Fi connection dropped. Additionally, the researcher took notes during the interviews to capture the settings and non-verbal behaviors.

Before the interview, the researcher asked participants to complete the demographic questionnaire (Appendix B). After that, the researcher informed the participants that the length of the interview would be at least 45 minutes, and the interview was recorded and was kept confidential. After each interview, the researcher wrote a memo to reflect her experiences and noted down any information which helped create follow-up questions. Then, the researcher transcribed the interviews, including both verbal and non-verbal communication, sounds, and surrounding phenomenon. The video and audio recordings were transcribed and stored in a

password-protected laptop. After finishing transcribing the interviews, the researcher used the member checking method (Patton, 2015) to gather feedback from the participants. Patton (2015) defined member checking as a method for researchers to recontact interviewees to "clarify or deepen responses" and "verifying data, findings, and interpretations with the participants in the study" p. 766). The researcher sent transcripts to ask participants to check and make any necessary changes. This process helps to fill in some possible gaps that may occur during the interviews.

Observation

During the interview, the researcher asked participants to show one of their online courses for observation. The purpose of observing is to provide data that will "describe in-depth and detail the setting that was observed" (Patton, 2015, p. 322). The researcher took notes about the course's organization and activities and the interaction in the course. The process of observing revealed aspects that the participants would have struggled to fully express in words. The researcher also included impressions and feelings about the observation, which were used as part of the data to apprehend the setting and the people at the research site (Patton, 2015). After the observation, the researcher fleshed out the jottings into fieldnotes.

Documents

Documents were another source of data that the researcher used in this study. Patton (2015) emphasizes the importance of written documents as "a rich source data" and "a part of qualitative inquiry" (p. 14). In this study, the researcher only collected screenshots of the participants' courses that they shared during the interviews. To collect existing screenshots, the researcher informed participants that the researcher used screenshots of their courses in the Canvas LMS through the recorded video from the interviews.

Ethical Consideration

The researcher completed the Responsible Conduct of Research training, which is required for all graduate students. The researcher applied and received approval from the Institutional Review Board before starting the study.

For the interviews, the researcher prepared a consent form for the interviewees to read and sign electronically. The researcher informed the interviewees that what they said would not be identified under their name. The researcher used pseudonyms instead of people or organization's real names. The interviewees were informed that when the study was completed, all the recordings were destroyed.

Trustworthiness

Trustworthiness plays an important role in enhancing "the quality and credibility of qualitative analysis" (Patton, 2015, p. 652). The credibility is achieved via triangulation, which is defined as a method to compare and cross-check "the consistency of information derived at different times and by different means from interviews, observations, and documents" (Patton, 2015, p. 662). In this study, the process of collecting data came from three main sources, including interviews, observations, and documents (screenshots), which is referred to as triangulation - a qualitative research strategy to establish a detailed view of the phenomenon (Patton, 2015). Triangulation also increases the dependability of the study when the same information is gathered through observation during the interview and member checking. Member checking, a qualitative research technique, validates the credibility of the interviews. After transcribing the interviews, the researcher returned the interview transcriptions for interviewees to check for accuracy. To establish transferability, the researcher provided detailed and rich descriptions of the results of this study about the implementation of technology tools in online settings to facilitate online interactions.

Data Analysis

There were seven participants in this multiple case study. The process of interviewing each participant was from May 20, 2021, to June 3, 2021. Table 1 displays the list of participants who were interviewed. The researcher used pseudonyms to keep the participants from being identified.

Table 1

Interview Participants

Pseudonym	Rank	*n* years teaching online	College	Gender
Ms. Karen	Adjunct Instructor	5	Business	Female
Dr. Geoffrey	Associate Professor	9	Education	Male
Dr. Thomas	Associate Professor	2.5	Arts & Sciences	Male
Dr. Olivia	Associate Professor	2.5	Arts & Sciences	Female
Dr. Nadia	Assistant Professor	9	Education	Female
Dr. Rosalind	Assistant Professor	2	Agriculture	Female
Ms. Cheryl	Instructor of Professional Practice	1	Business	Female

In this study, the researcher used analytic induction approach to code the data from the interviews. The analytic induction approach is the combination of deductive and inductive analysis approaches (Bingham & Witkowsky, 2022; Ligurgo et al., 2017; Patton, 2015; Vidich & Lyman, 2000). The researcher started coding deductively based on research questions, and then continued inductively with codes and categories. Deductive analysis enables researchers to predetermine codes to "support existing general conceptualizations, explanations, results, and/or theories" (Patton, 2015, p. 791). According to Bingham and Witkowsky (2022), deductive

coding, or *a priori* coding, is used to organize data, retain consistency with research questions, and apply theory. The researcher applied deductive coding to the data from interview transcripts and observation notes following the structure of interview protocol (Appendix B). The interview questions were guided by the theories of interaction (Hillman et al., 1994; Moore, 1989) and the TRM framework (Kopcha et al., 2020) to identify the implementation of technology tools to promote online interaction. The researcher identified a list of codes based on "Why" and "How" research questions and interview questions. Hence, the predetermined codes included "reasons", "experiences", "technology facilitated interaction" (learner-instructor, learner-learner, learner-content, learner-interface), and "challenges".

The researcher continued analyzing data inductively after predetermining codes. Inductive analysis, or open coding, helped develop new ideas, explanations, and findings from the data collected (Patton, 2015). The researcher followed the data analysis spiral described by Creswell and Poth (2016). The process included five stages: "managing and organizing the data, reading and memoing emergent ideas, describing and classifying codes into themes, developing and assessing interpretations, and representing and visualizing the data" (Creswell & Poth, 2016, p. 255). The researcher analyzed words and phrases from interview transcripts and fieldnotes to examine and understand the participants' thoughts and recommendations, and then the researcher sorted the data according to the priori codes (Bingham & Witkowsky, 2022).

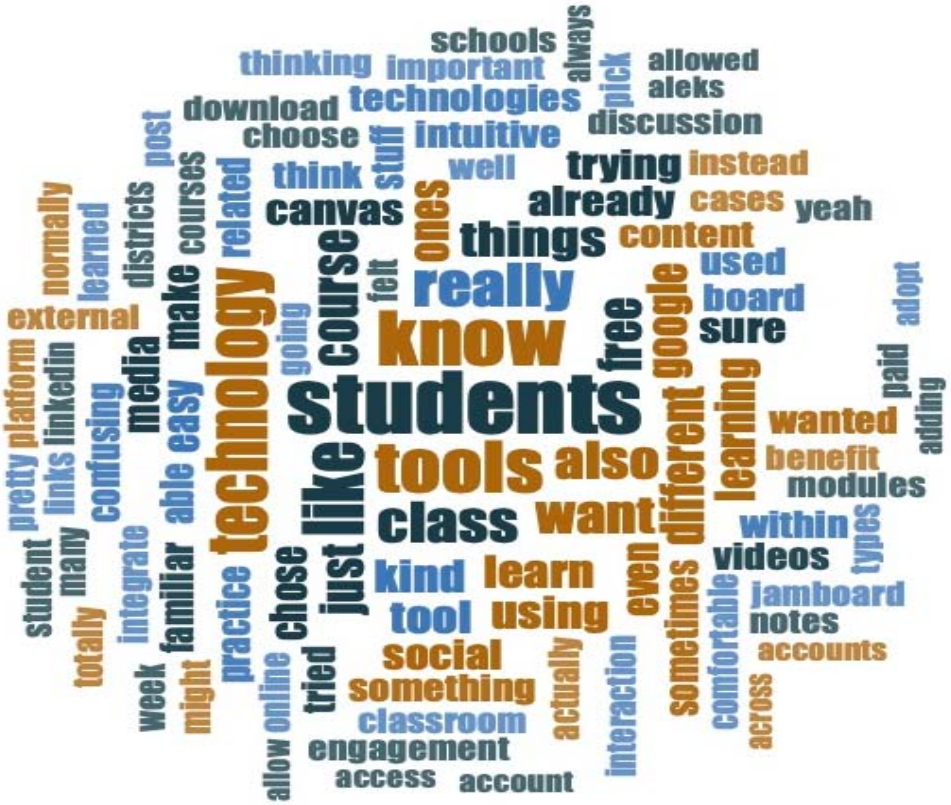
In the first stage of the data analysis spiral (Creswell & Poth, 2016), the researcher organized the data into two categories, including written data (i.e., interview transcripts and fieldnotes) and visual data (i.e., screenshots). To analyze the data collected (i.e., interviews, observations, and screenshots), the researcher combined the use of NVivo - a popular qualitative analysis software program - and manual coding. The researcher used the latest version of NVivo which was released in March 2020. Patton (2015) stated that "qualitative software programs facilitate data storage, coding, retrieval, comparing, and linking—but human beings do the

analysis" (p. 773). Research has shown that using a software to analyze qualitative data improves the transparency of the analysis process (Woods et al., 2016).

In the second stage of the data analysis spiral (Creswell & Poth, 2016), the researcher explored the data collected by using word frequency criteria in NVivo. The result was presented in a wordcloud (Figure 2) that enabled the researcher to recognize the most frequent words mentioned in the interviews. I showed that "technology", "tools", "students", "know", and "different" were used more than other words. A number of other high-frequency words were in different categories, such as technology (i.e., Aleks, Jamboard, Google) and experience (i.e., comfortable, confusing).

Figure 2

View of the Written Data Using Word Frequency Criteria in NVivo



The third stage is defining and categorizing codes into themes (Creswell & Poth, 2016). The researcher began developing codes by selecting words, phrases and sentences in each written document that were important and relevant to the predetermined codes from the deductive process. The researcher analyzed the interview transcripts and field notes thoroughly several times to add additional codes and organized data into different categories and identified several themes that aligned with the interaction theories by Moore (1989) and Hillman et al. (1994) and the interview questions guided by the TRM (Kopcha et al., 2020) to answer the research questions.

In the last steps, the researcher reviewed the codes and themes, visualized the data using NVivo to check if there were any missing codes, and finalized the information used to display the data analyis. Data collected from screenshots were analyzed manually. The researcher took relevant screenshots from each interview and stored the screenshots in a folder in a password-protected computer. After that, the researcher arranged the screenshots into categories that connected to identified themes from interviews and fieldnotes. The researcher presented and summarized the major results in Chapter 4.

Summary

This chapter described the research methodology that was employed in this research study. Interviews were conducted to investigate the instructors' implementation of technology tools in their online courses. The results of the present research provide insight into the decisions and practices of exemplary instructors to increase the knowledge of what and how they do in their online courses.

CHAPTER IV

PRESENTATION OF CASES AND FINDINGS

The purpose of this case study was to explore the exemplary instructors' implementation of technology to promote interaction and interactivity in their online courses. The researcher used structured interviews to investigate what type of technology instructors used, how instructors chose technology, and why they chose the technology to facilitate interaction in their online courses. The following research questions led this study:

1. What technology tools do instructors choose and use to facilitate online interaction and interactivity?
2. Why do instructors choose to adopt technology tools to facilitate online interaction and interactivity?
3. How do instructors choose technology tools for online interaction?
4. How do instructors use technology tools for online interactivity?

The researcher contacted ten instructors who were nominated for the 2020 Online Teaching Excellence award at the South-central University in the United States to explain the purpose of the study and invite them to participate in the study. Seven instructors responded to the invitation email to participate in the interview. For the purpose of this multiple case study, seven instructors were considered as seven cases. This chapter begins with a detailed description

of each exemplary online instructor's case to provide relevant information about the backgrounds and teaching contexts. Then, the researcher presented findings in accordance with the themes, which were identified through data analysis.

Presentation of Cases

The researcher presented a description of the instructor's background information, teaching contexts, and implementation of technology tools. The TRM framework (Kopcha et al., 2020) was used to describe the process of choosing and using technology, including the reasons for choosing technology (instructors' belief, understanding, and experience), the evaluation and identification of the final technology (decision making), and the practice of using technology (actual technology use).

Case One: An Adjunct Instructor of Business

Ms. Karen, who has more than 16 years of experience in higher education, has taught more than ten online courses during her five years teaching online. In 2017, she won an award for excellence in instruction from a national organization related to distance learning. During the 45-minute interview, Ms. Karen used her online asynchronous Marketing course as an example to show how she implemented technology to foster interaction. In this course, students only worked individually; however, she stated that she had to "build all the interaction in apart from teams for this one." Ms. Karen indicated that she planned to promote interaction in different ways with this asynchronous course. For example, she said,

> We set everything up in pages for both of my courses, um we feel like I get really good responses from students on this and we're working all the time. I feel like just the interface of even how you design a course is the introduction to how students… how they feel about the course how they interact with it.

The Reasons for Choosing Technology. In terms of technology used to support interaction, Ms. Karen described the use of Padlet, an online note board, as a discussion board. Based on her belief, experience, and understanding, she indicated that Padlet was more than "a normal discussion board." She explained the reasons for not choosing the Canvas Discussion Board as "you could post one and you could see links and then you have to go to download each link. And then, sometimes they wouldn't upload right and sometimes they couldn't download them, and we hit max capacity." Ms. Karen also indicated the reason for choosing Zoom, an online conference tool, as "Zoom is convenient to use for the synchronous class", she said. Finally, Ms. Karen shared that she chose the technology because there was no cost. She said, "I want free. I want to be able to provide free for the students."

The Evaluation and Identification of the Final Technology. Ms. Karen showed her evaluation on Canvas Discussion Board as "It's frustrating. You're supposed to interact with each other, but you have to pull up in each message and then try to download each image." Then, she decided to use Padlet after identifying that the app could support online interaction. She evaluated Padlet as "it worked pretty well. I used Padlet for the other teams to share their posts, and it worked well for sharing videos as well." She added, "this allows them to interact, they can vote on each other's," and "they can ask each other questions… This is cute."

The Practice of Using Technology. Ms. Karen asked students to post their work into Padlet and interacted with each other by asking and answering questions. She also asked students to vote to receive prizes. She indicated that "they can vote, we can give prizes. I gave prizes this week. I gave out their choice of coffee gift cards or bonus points for the winner." After implementing Padlet for this class, Ms. Karen also set up this app for the other class to foster interaction between students, and interaction between students and instructor. Then, she added, "Padlet has really helped them interact with each other."

Besides Padlet, she also mentioned other technology tools, such as Flipgrid, Google Jamboard, Buffer App, and social media sites. For example, after using Flipgrid in the first week of this class for an introduction task, she evaluated that "Flipgrid didn't work as I'd hoped, meaning that class has 100 and most of them weren't watching and responding to each other." So, she expressed her decision that "for it didn't work so well and we'll try something else next semester." Overall, she shared her satisfaction with over 80% of students who used the tools and interacted during her asynchronous class.

Case Two: An Associate Professor of Education

Dr. Geoffrey has more than 14 years of experience in higher education. He has taught ten online courses at the undergraduate level and more than 20 online courses at the graduate level during nine years of teaching online. He was nominated and received the 2020 Online Teaching Excellence Award at the south-central region university in the United States. During the 69-minute interview, Dr. Geoffrey introduced two online courses to illustrate how he implemented technology.

The Reasons for Choosing Technology. When describing the first course, Weekend Film, Dr. Geoffrey mentioned that he assigned students to watch a movie by midnight each Friday, and then they participated in the course discussion board by Sunday midnight. He expressed his interest in the Big Blue Button in Canvas, a web conferencing system that is integrated into Canvas; however, he did not use this tool for his online course. He explained why he did not choose the Big Blue Button as "the developers need to do additional work on that particular piece of software."

The Evaluation and Identification of the Final Technology. Based on experiences with the use of Zoom, a conference tool, Dr. Geoffrey decided to choose Zoom as the primary technology for his online Weekend Film course. He evaluated Zoom as "a really interesting

technology", and he mentioned some of the features that he liked when using Zoom, such as attendance taking and screen sharing.

The Practice of Using Technology. Dr. Geoffrey showed the implementation of video-oriented activities in another course relating to the process of developing products. He highlighted the importance of using videos in teaching online. In this course, students completed two major assignments by watching five different videos, which Dr. Geoffrey recorded via Zoom and used Camtasia studio, a screen recorder, and video editor, to edit the videos. He also mentioned an example that he used Zoom to conduct mock interviews with students in his online Pre-internship course. He set up breakout rooms for students to meet and have a mock interview individually with industry people in the field of study. Dr. Geoffrey indicated that the breakout rooms function in Zoom worked very effectively for that kind of interactive activity. He said that he would continue using Zoom, and he recommended the investment in the online seminar function. He said, "The whole point is webinar components, whether webinars of collaborative projects, perhaps with other schools, are essential functionality in online teaching for the future."

Case Three: An Associate Professor of Art and Sciences

Dr. Thomas has more than ten years of experience in higher education, in which he has taught eight online courses for two and a half years teaching online. In the interview, he talked about an online course, Chemistry for Engineers, that he developed and taught during the Pandemic. The course was offered for a university in the south-central United States and a university in China. In this course, he implemented Light Board, Green Screen, Canvas Studio, and Canvas Conference to foster online interaction.

The Reasons for Choosing Technology. The reason for choosing Light Board, according to Dr. Thomas, was to increase instructor presence in his online course. He said, "Like as if you were in class with me. To do that, I need you to see me… to see my hands' motions, to

see how my eyes are talking". He used Green Screen to easily change the background of the video. Dr. Thomas indicated that he selected Canvas Studio and Canvas Conference as these tools were integrated into Canvas LMS and were convenient to use.

The Evaluation and Identification of the Final Technology. Dr. Thomas highlighted the importance of the syllabus videos and lecture videos created using Green Screen and Light Board as "actually very important that I can direct the students back to when they have a question." Another technology that Dr. Thomas chose to promote interaction in his online course was Canvas Conference to organize virtual office hours and review sessions. According to Dr. Thomas, virtual office hours play an important role in connecting, engaging, and interacting with his students. He explained that "the personal connection is something that has been missed from online and I try to do my best technologies to provide that."

The Practice of Using Technology. Dr. Thomas illustrated the use of a Light Board and Green Screen when recording a video. The Light Board, a lighted glass chalkboard, enabled him to show his notes while he was lecturing, and the Green Screen was used to change the background of the video. For each video, he tried to keep the length between five and eight minutes so students could easily digest the content. Dr. Thomas emphasized the importance of preparing videos when the researcher asked if he could give advice to online instructors who wanted to integrate technology tools into their courses. He indicated the instructors should prepare professional and high-quality videos because those videos "can portray what you really want from the lecture."

Then, Dr. Thomas mentioned the actual use of the Canvas Conference. He said, "doing these virtual office hours means you have me on camera. You have me also going through the lessons that you had questions that you asked. I have a Whiteboard to go through the questions."

He also expressed his eagerness to learn about new different online technology tools that would support engagement and interaction with students.

Case Four: An Associate Professor of Arts and Sciences

Dr. Olivia has six years of experience in the field of Political Science in higher education. She has taught eight online courses for two and a half years teaching online. She expressed that in her online courses, she organized the course site like a blog post where she said it was "very simple" and "very easy" to locate information and materials. During the interview, she showed a synchronous online course, Political Science. In this course, in addition to the use of short videos, she used Discussion Board in Canvas for weekly discussions to foster interaction (i.e., learner-instructor interaction, learner-learner interaction).

The Reasons for Choosing Technology. Dr. Olivia did not use a large variety of technology tools in this course. She explained, "I think everyone's already a little bit tired and maybe over-exposed to a lot of different technologies, so I didn't really feel like introducing something new; I actually wanted to use somehow a format that they're comfortable with." In terms of choosing technology, Dr. Olivia mentioned that she used short videos, Canvas Discussion Boards, Hypothesis (an online annotation tool), MindTap (an online interactive learning platform), and a web-based flash game to promote online interaction. For example, she explained that she chose Canvas Discussion Boards because its format was easy to implement. She also mentioned that she chose a web-based flash game for students to practice the concept and interact with technology. She said,

> I introduced this concept of sustainable cities, and then the students have to go to … They get a chance to build a sustainable city. So, they go to something called Urban Climate Architects, and they actually have to simulate.

The Evaluation and Identification of the Final Technology. When talking about the decision to use the Urban Climate Architect as a web-based flash game, Dr. Oliva indicated

> So, this is the kind of stuff that I would do with them normally in class. So, what I was really thinking about was how do I make this online environment just as interactive and hands-on and applicable as my normal class would be.

She also expressed one of her concerns relating to the use of technology to support online interaction. She said,

> Students and faculty are tired, and they don't need another thing to learn in addition to their actual learning, but to also learn how to connect with each other. Or maybe that's just how I felt, but that was my driving force was how can I try to encourage interaction between the students without making their lives more difficult.

The Practice of Using Technology. Dr. Olivia described how she asked students to use the Urban Climate Architect, the web-based flash game. She started the activity by creating a discussion board in Canvas to provide context and related content. Then, she assigned students to participate in the game. She said,

> They actually have to simulate building a city by adding on different types of… here's a train and here's a tree, etc. And then they build a city, and then they see what happens to their… their CO2 emissions, rainwater temperature, etc. And then I asked them to build a city and each of these differences when they call it silly things like Asia town something else. And they have to compare how those regions are different.

Dr. Olivia also mentioned that she would like to try to implement more tools to improve interaction in her online courses. She provided several recommendations for new online instructors. For example, she said,

> My very first tip is that you need to really figure out the functionality of the online mechanism or tool that you're using to actually deliver your course content. And then,

> something else I would recommend is to be really, really organized so that students know where to go and know how to find what they need to do. And then, always put the same thing there, and so they can they know what to expect, and it doesn't get confusing.

Case Five: An Assistant Professor of Education

Dr. Nadia has more than 14 years of experience in both K-12 (9 years) and higher education (5 years). She taught six online courses during six years of teaching online in K-12. She has taught 12 online courses at the undergraduate level and eight online courses at the graduate level for three years teaching online in higher education. In 2021, Dr. Nadia won an online learning excellence award from the South-Central state Council. During the interview, she talked about the implementation of technology tools in one of her online courses for teachers or pre-service teachers to learn how to teach with technology. In this course, Dr. Nadia introduced a various type of technology and created activities/assignments using such technology.

The Reasons for Choosing Technology. Dr. Nadia indicated one of the reasons she chose technology to implement in her online course was "They were tools that students would be able to access for free once they are in schools." Then, she explained the use of 12 technology tools in one of her online educational technology courses. She said,

> There is a lot more technology being used than might be typically in an online course. And that's intentional for the purpose of modeling different technologies that the teacher or pre-service teachers can use once they get into their classrooms.

The Evaluation and Identification of the Final Technology. Dr. Nadia shared how she selected the tools as "I tried to intentionally make sure that there are different ways to represent the course content." For example, she evaluated that Flipgrid was good to use for students to get to know each other in the first week of the course. Canvas Discussion Board, according to Dr. Nadia, supported interaction. She said, "it did have students interacting with each other, had me interacting with them." Similarly, she identified Padlet as a tool for students to "interact with both

course content and each other in this class" and use "technology in different environments." But also, again, like that first week, had them interacting with content." She indicated that choosing technology tools also depended on different criteria, such as school districts' policies and evaluation of IT departments. She evaluated and decided on the final technology mostly to promote online interaction.

The Practice of Using Technology. During the interviews, Dr. Nadia showed how she used technology to design the course content. For examples,

Flipgrid. She created a fun activity for students to get to know each other by asking them to record a video in Flipgrid to talk about themselves with "two truths and a lie." And then, each of the students asked their peers to "try to guess what the lie is, and then students will reveal their lie in the next week's discussion board," she described. Her overall evaluation of implementing this activity was, "So, it's kind of a fun way for students to get to know each other, and it's, I mean, fun trying to guess everyone's life well."

Google Slides. She asked students to work independently to create their own activities by applying their understandings of the content from the previous week. Students also used Google Slides to record a three-minute presentation to illustrate what they had learned about their topic.

Google Docs. Dr. Nadia required students to create their own lesson plan and provide their evaluation of technology tools on Google Docs, which were being public. She said that by using Google Docs, she could provide her feedback, and her students "were able to see their peers work to get an idea of whether or not they would want to use some of that technology in their own their own lesson plan."

Padlet. Students were asked to list out the pros and cons of different classroom technology provided in Padlet. Then, students read through each other's and created their own technology management plans to use in their classroom. Dr. Nadia evaluated the implementation

of Padlet as “kind of another collaborative space, and they could reflect on each other's thoughts about pros and cons, and then apply that through creating their own technology management plan.”

Stormboard. Dr. Nadia used Stormboard for her students to brainstorm different topics related to educational technology. This tool allowed students to share, exchange, and contribute their ideas to each other. Although Dr. Nadia felt satisfied with the way students interacted using the tool, she indicated that she needed to replace this tool after this course. She explained that some changes from the tool owner made the tool not useful.

Dr. Nadia shared her satisfaction with using technology to promote interaction within her online course. She said, “the tools serve their purpose in…that day, and not only helps students interact with course content with each other and with me.” Besides her satisfaction, Dr. Nadia expressed her concerns about how students interacted with technology and content when taking online courses. For such reasons, she indicated that “I always remind myself when I’m selecting my tools is, what is the purpose of this assignment? What am I wanting students to do, whether it's reflecting on the course content? And what the purpose of using this tool is.”

Case Six: An Assistant Professor of Agriculture

Dr. Rosalind has had more than ten years of experience in higher education, and she has taught about five online courses. She has experience in teaching asynchronous online courses. Due to Covid, most of her HyFlex courses, or hybrid – a combination between face-to-face and online in a course, changed to fully online courses. She introduced two of her online courses during the interview.

The Reasons for Choosing Technology. Dr. Rosalind mentioned that she chose technology tools for the Digital Media online course not only to introduce different technology but also wanted her students to be able to use such technology in their future careers. She showed

that she was very careful when choosing technology to facilitate the course. For instance, she challenged her students to use several technology tools with which they were not as acquainted. Her students were asked to complete some free online certificates from top leaders in their field. She explained that such interactivity both verified her students' knowledge and provided them with hands-on experience.

The Evaluation and Identification of the Final Technology. Dr. Rosalind talked about the use of GroupMe, a text messaging tool, to help students interact with each other. She preferred this tool because it helped promote communication faster and more effectively during the asynchronous hours. For synchronous sessions, she used Zoom to interact with her students and encouraged students to interact with each other using chat or microphone.

The Practice of Using Technology. Dr. Rosalin began by describing how she used Canvas to create pages, assignments, and quizzes in one of her online courses. For the course lecture, she used Studio in Canvas, a video tool, to embed a quiz into the video to "ensure that students were participating and fully watching and engaging with the videos." She also indicated the combination between lecture and quiz in a video was unique since it "was a way that it helped me ensure that the students were not just hitting play on a YouTube video and walking away, and I ensured that they were actually watching the videos." She highlighted the analytic feature in Canvas that enabled her to see how students interacted with the course content. Dr. Rosalind identified the best way to use technology tools for interaction in online courses: "to be consistent in how you're using the tool" and "to follow the same steps every week as well."

Case Seven: An Instructor of Business

Ms. Cheryl has two years of experience in higher education as an instructor of Professional Practice in a Business School at the South-central University. She taught two online courses during her first year of teaching online. She shared the course "Foundational Accounting

Skills" in which she implemented interactive technology tools. She introduced how she organized the course by using buttons to help students locate the technology tools easily. During the interview, she showed technology tools that she implemented to improve interaction in her online course, such as Zoom, Aleks, and Connect.

The Reasons for Choosing Technology. When explaining the reason why choosing technology, Ms. Cheryl provided an example of using Aleks for math placement. She said, "Aleks is really cool. This is the technology I chose because it's tailored for the student." Ms. Cheryl also mentioned that she chose the technology that helped facilitate online interaction.

The Evaluation and Identification of the Final Technology. Ms. Cheryl shared that the way she evaluated and identified the final technology tools in her online course was based on students' usage. She said,

> We got rid of all the ones that were confusing or were not explained well. We just deleted those out. And so, we kept the ones that were really explained well. We got rid of some of the ones that were just making them [students] frustrated or taking them a long time to get through.

Ms. Cheryl talked about choosing Connect, a Mcgraw Hill software since she was able to interact with students, and students could interact with each other. She indicated that when students completed their assignments, "they can interact with their classmates online and get help from them. But they can't just copy their answers because if they copy their answers, they're using someone else's numbers, and it would be wrong."

The Practice of Using Technology. Ms. Cheryl used Canvas Discussion as the main tool for her to interact with students. She described the task that she designed, "I have them upload to Canvas a screenshot of the question that they didn't understand, or they had a problem with." She talked about the use of Connect for students to do homework by providing "the problems algorithmic

which means everyone gets the same problem, but they have different numbers like, no one has the same numbers." Additionally, she used Aleks as a pre assessment tool. She said,

> Depending on how they score on the pre-assessment, they have a certain amount of pieces of a pie to fill. So, they do really well in the understood everything. They might not have that much to do, but if they miss a lot of stuff on the pre-assessment and they weren't really paying attention really didn't understand. Then, they have a lot of work to do in Aleks, so it's tailored to what they do and don't know.

Findings

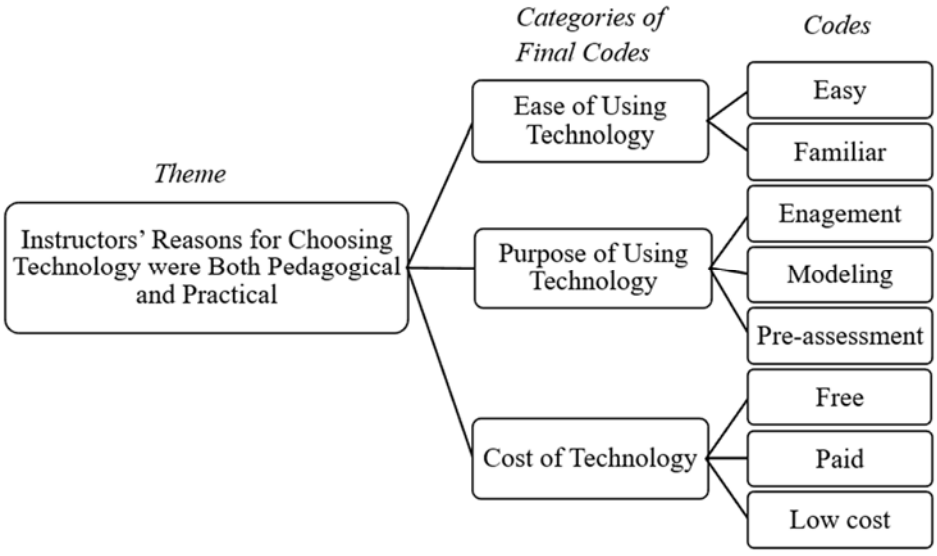
The findings reported from the study provide answers to four research questions mentioned at the beginning of this chapter. The research questions were developed from theories of interaction by Moore (1989) and Hillman et al. (1994). The data collected and analyzed from interviews were used to reveal instructors' beliefs, knowledge, and experience (Kopcha et al., 2020) to address the research questions. In this study, the researcher used the analytic induction approach to code the data from the interviews and observation field notes. Following multiple times reading the interviews, field notes, and initial codes, the researcher generated a final list of codes, which were then categorized into four major themes: (1) Instructors' reasons for choosing technology were both pedagogical and practical; (2) Instructors' experiences in choosing technology tools for online interaction; (3) Instructors incorporate all four components of the Theory of Interaction (Hillman et al., 1994; Moore, 1989) in their use of technology tools; and (4) Instructors faced several challenges when implementing technology to facilitate online interactivity. The coding process, which used the analytic induction approach to code the data from the interviews and field notes, was illustrated in Figures 3-6.

Figure 3 illustrated the coding procedures for the theme "Instructors' Reasons for Choosing Technology were both Pedagogical and Practical." This theme was finalized from three code categories (i.e., ease of using technology and purpose of using technology. The development

of the categories was identified based on the combination of the initial code "reasons" from the deductive analysis process and the reviewed codes from the inductive analysis process. For example, the code "Easy" was identified as one of the reasons why exemplary online instructors chose technology to support interaction. One of the participants, Ms. Karen, expressed that "When I'm selecting external Apps to integrate, I look for things that are super easy to pick up and learn that are like intuitive." Similarly, the other codes were identified based on the initial code "reasons." After having a number of codes related to the priori "reasons," the researcher grouped the codes into three categories, including "Ease of Using Technology," Purpose of Using Technology," and "Cost of Technology."

Figure 3

Example of Coding Procedures for Theme "Instructors' Reasons for Choosing Technology Were Both Pedagogical and Practical"

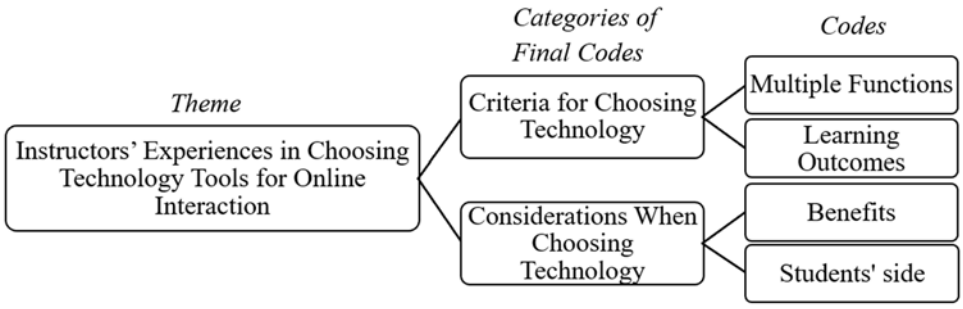


The coding process for the theme "Instructors' Experiences in Choosing Technology Tools for Online Interaction" is shown in Figure 4. The researcher began by identifying the code "experiences" from the research question, "How do instructors choose technology tools for online

interaction?" After that, the researcher identified a list of related codes (i.e., multiple functions, learning outcomes) inductively from the interview transcripts and field notes. For example, the code "multi functions" was identified in the interview with Ms. Karen when she shared her experiences in choosing technology. She said, "I really would like something that's more multifunctional because they're so specific that if I want any different functionality, I need to add in... more Apps and more Apps." The last step in forming this theme was to organize the final codes into two categories: Criteria for Choosing Technology and Considerations When Choosing Technology.

Figure 4

Example of Coding Procedures for Theme "Instructors' Experiences in Choosing Technology Tools for Online Interaction"

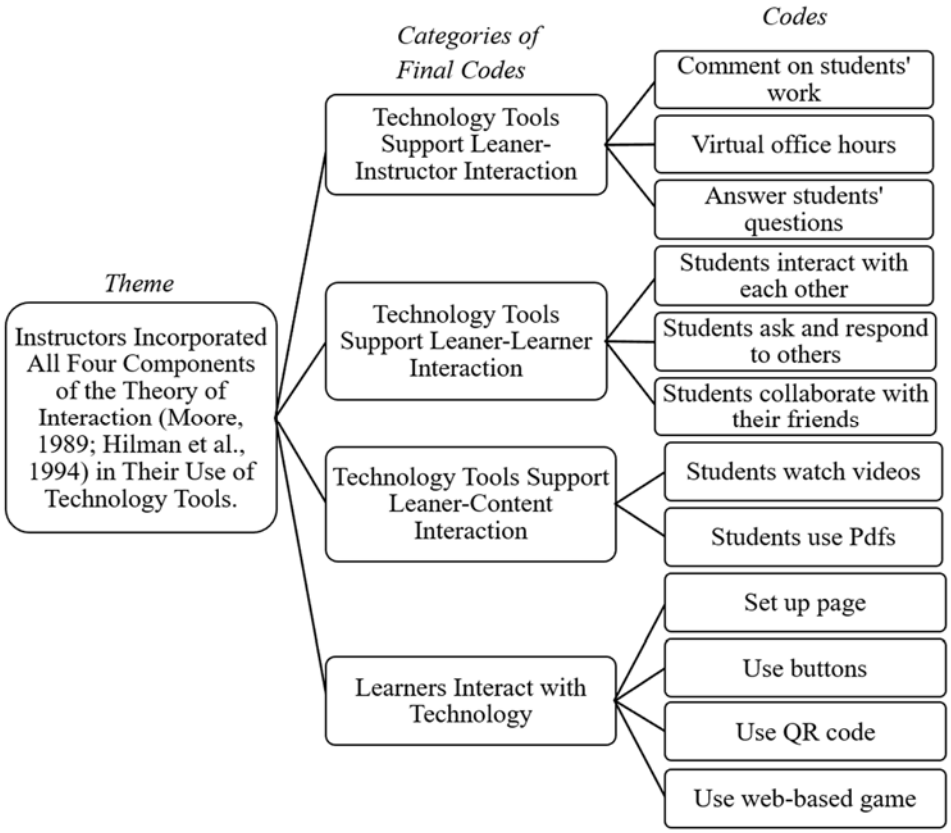


The theme "Instructors Incorporate All Four Components of the Theory of Interaction (Hillman et al., 1994; Moore, 1989) in Their Use of Technology Tools" was developed through a similar process as the previous theme. Figure 5 provides an overview of the coding procedure based on the predetermined code "technology facilitated interaction." The researcher focused on the theories of interaction (Hillman et al., 1994; Moore, 1989) to explore the data to find the related codes that showed how exemplary instructors chose technology to facilitate four types of interaction (learner-instructor, learner-learner, learner-content, learner-interface). The list of final codes was identified and grouped into four categories. For instance, the code "Comment on

students' work" was grouped into the category "Technology Tools Support Learner-Instructor Interaction" because one of the participants used Flipgrid videos to interact with the student. The participant said that "I've worked questions into the actual video itself so that the students will comment back and forth on the video. So, you can see here, like you can see the different points in the video where students have answered questions that I've commented in [on] the video."

Figure 5

Example of Coding Procedures for Theme "Instructors Incorporated All Four Components of the Theory of Interaction (Hillman et al., 1994; Moore, 1989) in Their Use of Technology Tools."

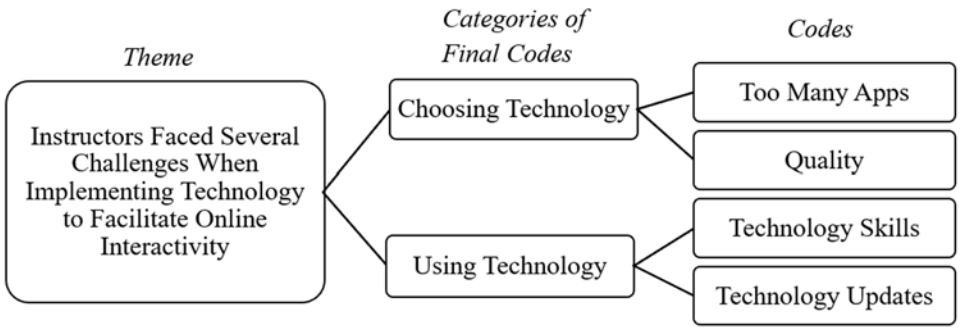


The inductive coding procedures for the theme "Instructors Faced Several Challenges When Implementing Technology to Facilitate Online Interactivity" are demonstrated in Figure 6. Based on the predetermined coded "Challenges," the researcher explored the data from the

interview transcripts and field notes to find related codes that revealed participants' challenges and difficulties when implementing technology to foster interaction in online courses. For example, the code "technology skills" was identified through different interview transcripts. One instructor, Dr. Thomas, shared his level of technology skills as "One of my biggest problems is that I'm not tech-savvy. And so, I really need training of [on] how to use the tool effectively sometimes." Another instructor, Dr. Rosalind, indicated the problem she faced as "the challenge is that not all students are technologically savvy and can troubleshoot things on their own always can cause some trouble."

Figure 6

Example of Coding Procedures for Theme "Instructors Faced Several Challenges When Implementing Technology to Facilitate Online Interactivity"



Types of Technology Tools

The purpose of this section was to discover what technology tools were implemented by the instructors to promote interaction and interactivity in their online courses. The findings, which were obtained from the interview transcripts and field notes, provided answers to the first research question, "What technology tools do instructors choose and use to facilitate online interaction and interactivity?"

During the interviews, participants indicated a number of 41 technology tools implemented in their online courses, such as Google Tools, Lightboard, Canvas Discussions, and Zoom. The researcher found 34 tools used by the instructors that supported interaction and interactivity in online courses. The data from the interviews showed that Zoom was the most popular tool used by five in a total of seven participants. The list of technology and a description of each tool are organized into categories in Table 2. Although the review of the literature showed that technology included asynchronous tools and synchronous tools, the data analysis in this study revealed a number of technology tools could be used to support both asynchronous and synschronous online interaction. For that reason, technology tools found in this study were classified according to its purpose (i.e., learning management system, online learning tools, and social media tools) and presented in Table 2 .Types of interactive support were also provided to illustrate for the use of technology to promote online interaction.

Table 2

List of Technology Tools

Tool	Description	Interactive Support
	Learning Management Systems	
Canvas	An online LMS	Learners view and download course materials. (Learner-content Interaction) Learners navigate the page to complete the task. (Learner-Interface Interaction) Learners post and answer questions. (Learner-learner and Learner-instructor Interaction)
Google Classroom	A free online LMS	Learners create their own classrooms. (Learner-interface Interaction)
	Management and Collaboration	
Basecamp	An online management app	Learners work in teams to communicate and manage the task. (Learner-learner Interaction)
Connect	A homework and learning management software by Mcgraw Hill	Learners interact with content and their classmates. (Learner-content and Learner-learner Interaction)

Tool	Description	Interactive Support
Google Docs	An online app to create documents	Learners interact with peers and with their instructor. (Learner-learner and Learner-instructor Interaction)
Google Jamboard	An online digital whiteboard	Learners interact live with each other. (Learner-learner Interaction)
Padlet	An online note board	Learners post their designs. Learners interact with each post by voting. (Learner-content Interaction)
Stormboard	An online platform to generate ideas	Learners interact with content and their classmates. (Learner-content and Learner-learner Interaction)
	Online Learning Platforms	
Aleks	An online learning platform	Learners interact with the content and the tool. (Learner-content Interaction & Learner-interface Interaction)
HubSpot Academy	An online learning platform with free courses	Learners complete required courses and receive certifications. (Learner-content Interaction)
LinkedIn Learning	An online educational platform	Learners watch and complete free courses to receive certifications. (Learner-content Interaction)
MindTap	An online interactive learning platform	Instructors combine interactivities in MindTap with their content in Canva. (Learner-content Interaction)
	Discussion Boards	
Canvas Discussion Board	A discussion tool in Canvas LMS	Learners participate in discussions by posting comments and replying to the others' comments. (Learner-learner and Learner-instructor Interaction)
GroupMe Text	A free online texting platform	Learners to ask and answer questions in a messaging group. (Learner-learner Interaction)
	Presentation Tools	
Google Slides	An online presentation app	Learners create their lesson/ presentation (Learner-interface Interaction)
Nearpod	An online interactive presentation platform	Learners participate in a live presentation. (Learner-content Interaction)
	Multimedia	
Canvas Studio	A multimedia tool in Canvas LMS	Learners watch and interact with embedded quizzes in the video. (Learner-interface and Learner-content Interaction)

Tool	Description	Interactive Support
		Learners comment and reply to others under the video. (Learner-learner and Learner-instructor Interaction)
Edpuzzle	A web-based video tool	Learners interact with content and their instructor (Learner-content and Learner-instructor Interaction)
FlipGrid	A video tool	Learners create the video and interact with each other. (Learner-learner Interaction)
Google Drawings	An online tool to create multimedia images	Learners interact with the tool (Learner-interface Interaction)
	Conferencing	
Canvas Conference	A conferencing tool in Canvas LMS	Office hours, Review sessions (Learner-instructor Interaction)
Zoom	A cloud-based conference platform	Synchronous meetings, mock interviews (Learner-learner and Learner-instructor Interaction)
	Social Media	
Buffer	An online social media software	Learners work in teams (Learner-learner Interaction)
Facebook	An online social network	Learners interact with each other in the Social Media class. (Learner-learner Interaction)
Instagram	An online social network	Learners interact with each other in the Social Media class. (Learner-learner Interaction)
Pinterest	An online pinboard platform	Learners interact with each other in the Social Media class. (Learner-learner Interaction)
Twitter	An online news and social network	Learners interact with each other in the Social Media class. (Learner-learner Interaction)
YouTube	An online social media platform	Learners create a playlist of videos and create their own videos. (Learner-interface Interaction)
	Assessment/Survey Tools	
Classkick	An assessment app	Learners interact with content (Learner-content Interaction)
Google Forms	An online survey app	Learners submit a question, and then they can answer other learners' questions. (Learner-learner Interaction)
	Web Builder Tools	

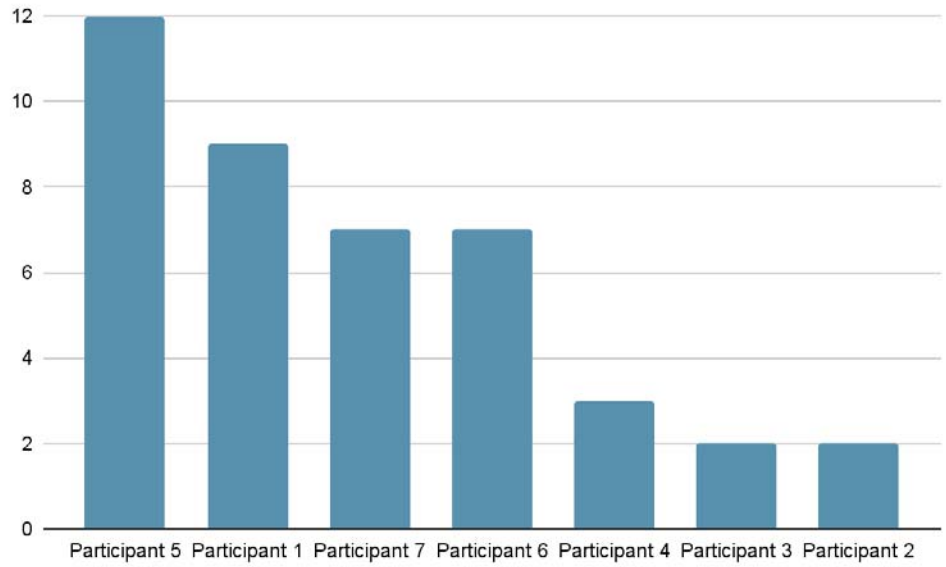
Tool	Description	Interactive Support
Google Sites	An online web builder	Learners use this tool to create their own content. (Learner-interface Interaction)
Wix	A website builder	Learners interact with each other in the Social Media class. (Learner-learner Interaction)
	Other Tools	
Google Drive	A cloud-based storage platform	Learners interact with files uploaded by the instructor. (Learner-content Interaction)
Urban Climate Architect	A web-based flash game	Learners create their own eco-friendly city. (Learner-interface Interaction)

Figure 7 describes the number of technology tools used for interaction in an online course by each participant. Depending on the purpose of the online course, participants used at least two technology tools to support online interaction in their online course. The data from the interviews showed that Dr. Nadia implemented more technology tools to facilitate online interaction and interactivity than other participants. Although the number of technologies varied depending on each of the participants, there was no difference in the success of implementing technology tools to promote online interaction. Hence, the purpose of this figure was to demonstrate the possible number of technology tools that foster interaction in each online course. Dr. Nadia explained that the number of technology tools (12) used in one of her online courses prepared learners (pre-service teachers) to teach with technology. She said,

> It's possible that there is a lot more technology being used than might be typically in an online course, and that's intentional for the purpose of modeling different technologies that the teacher or pre-service teachers can use once they get into their classrooms.

Figure 7

Number of Technology Tools Used in an Online Course



Reasons for Choosing Technology Tools

The purpose of this section was to answer the second research question, "Why do instructors choose to adopt technology tools to facilitate online interaction and interactivity?" The data collected from the sub-questions in the interviews asked participants' thoughts when deciding to choose technology tools to foster interaction and interactivity. The interview question was informed by the first step of the TRM model (Kopcha et al., 2020), which identifies reasons for using technology to discover instructors' desire to choose the technology. The theme "Instructors' reasons for choosing technology were both pedagogical and practical" was identified through the coding procedures."

Theme: Instructor Reasons for Choosing Technology were Both Pedagogical and Practical. The participants in the study discussed their reasons for choosing technology based on their beliefs and knowledge of the technology. This theme included the following categories:

Ease of Using Technology. This is the first reason that affects instructors' choice of technology tools is how easy it is to use the technology. Three out of seven participants indicated that they preferred the simplicity of using the technology to implement into their online courses. For example, Ms. Karen talked about her reason for choosing the technology as "When I'm selecting external Apps to integrate, I look for things that are super easy to pick up and learn that are like intuitive." In addition to her own belief and knowledge in selecting technology tools, Ms. Karen also expressed her previous experiences with students' perspectives when selecting technology. She said,

> Especially when I want to be able to use them for all students, ESL international students, or students who are older and not comfortable with technology because we have both, you know, we have across the board, all different types of students… And so, we want to [be] intuitive [and] easy to learn... And then, I want it to be something that I can use over and over so that they can get kind of going in class and not have to relearn new technology every week for an engagement facilitator.

Similarly, Dr. Olivia shared the reason why she chose Hypothesis. She said, "it's easy… I can see kind of how they're learning through the reading political science is such a really reading heavy and writing heavy feel." In addition, Dr. Rosalind talked about how easy she could manage her online course through the Canvas LMS. She said, "the way that I use Canvas as far as technology goes is I obviously would utilize some of the built-in things within Canvas in terms of pages and assignments with automatic deadlines and quizzes."

Purpose of Using Technology. Participants discussed the purpose of using the technology that affected their choice of technology tools as well. Ms. Karen chose technology as a type of facilitator to engage students. She said, "we're trying to build even engagement and interaction and something where you would normally have it in a class which would be in the lecture videos." Ms. Karen chose Zoom because "Zoom is convenient to use for the synchronous class."

This participant also indicated why she chose an outside technology instead of the Canvas LMS provided by the university. She said,

> We use Padlet for their designs, and it [is] just instead of a normal discussion board, we, the discussion boards felt within Canvas felt kind of blend like, you could, you could post one and you could see links and then you have to download each link. And then, sometimes they wouldn't upload right, and sometimes they couldn't download them, and we hit max capacity.

Dr. Thomas explained his reason for choosing Lightboard and Green Screen to engage his students. He said, “Like as if you were in class with me. To do that, I need for you to see me… to see my hands’ motions, to see how my eyes are talking.” He provided an example, “I can put my notes on up there [the Lightboard], and then I could write on the notes and the person who’s far from me can see that”. Dr. Thomas continued explaining, “Because that is very… that is very important for the students to realize that I’m a human, I’m not a robot.” Additionally, Dr. Nadia shared her experience in selecting technology. She said,

> It's possible that there is a lot more technology being used than might be typically in an online course, and that's intentional for the purpose of modeling different technologies that the teacher or pre-service teachers can use once they get into their classrooms.

When sharing the purpose for choosing the technology, Ms. Cheryl said, “What it does is it gives them a pre-assessment.” She explained, “When I chose it just because it's really repetitive and in really making sure that they practice, practice, practice, and get it down and, in fact, like students go from... like not really understanding anything in these modules.”

Cost of Technology. Participants in this study mentioned that they chose the technology because it is free for both instructors and learners. Ms. Karen expressed in her interview that “I want free, I want to be able to provide free for the students.” Dr. Nadia also said, “They were tools that students would be able to access for free once they are in schools.” Similarly, Dr. Rosalind explained why she chose LinkedIn Learning as “The courses and the videos that I

required students to watch were freely available. LinkedIn Learning, because of the pandemic, offered up a few of their courses for free, then it's normally a paid tool."

Experiences in Choosing Technology Tools

This section aimed to answer the third research question, "How do instructors choose technology tools for online interaction?" The data collected from interview questions, which were informed by the TRM framework (Kopcha et al., 2020), reflected instructors' beliefs, understanding, and practices to choose technology for online interaction. The theme developed through the data analysis was "Instructors' Experiences in Choosing Technology Tools for Online Interaction."

Theme: Experiences in Choosing Technology Tools for Online Interaction. The participants in this study shared their experience in choosing technology tools to facilitate interaction in their online courses. The data showed two main categories for this theme.

Criteria for Choosing Technology. Participants listed several criteria that affected their technology selection. Ms. Karen shared her decision-making experience when choosing technology with multi functions. She said, "I really would like something that's more multifunctional because they're so specific that if I want any different functionality, I need to add in... like more Apps and more Apps." Ms. Karen illustrated her choice of Padlet as "it is... has enough stretch and functionality, that I can use it in different scenarios." This participant added that she chose Padlet because "I want things that draw students in [to] make it easy for... for them to interact with each other and with me."

Dr. Nadia mentioned how she selected the tools that "I tried to intentionally make sure that there are different ways to represent the course content, but then they also… in all of their assignments, they have lots of choices." She added,

> And so, you know, that they get they get to choose a lot of different things, and how they go about doing things. So, for instance, like the classroom technology management plan, they're creating essentially three posters to help manage technology in their classroom. And how they created those was totally up to them, so I gave them some suggestions, like you might use Canvas or Piktochart or even, you know, Google Drive or Google slides, but whatever you do is totally up to you.

Dr. Rosalind mentioned how she chose technology by indicating that "Technology that also would support the learning outcomes, and then also in some cases technology that they would be using in their future careers related to the topic… as far as facilitating the course." The participant shared her experience in selecting technology tools. She said,

> The course that I'm thinking of is a digital media course. So, the course... the content is related to technology. It's related to social media web design tools, and so when I was thinking about technology to incorporate into the course… I was pretty, pretty picky about tools that I used to facilitate the course, but tools that students used as part of course content.

Concerns When Choosing Technology. Besides multiple functions, participants expressed their concerns when selecting Dr. Thomas shared his concerns when choosing technology to facilitate interaction in his online course. He said, "I'm trying to work on two things, what is the benefit of [them] communicating with each other… I know the benefits of studying with each other."

Dr. Nadia described how she chose Padlet in her online course by identifying both advantages and disadvantages of the tool. She said,

> They [students] were learning about using technology in... in different environments… So, students were kind of listing out pros and cons, and reading through each other's because they were going to create their own classroom technology management plan that takes... that took into account some of these pros and cons.

Dr. Nadia continued to share how she selected technology tools to facilitate online interaction. She said, “If they [school districts] have policies, their IT departments are ones that are evaluating them for privacy and all sorts of concerns like that.” This participant also addressed that her process of deciding on appropriate technology tools involved testing the use of technology. She said, “For all of the different tools, I tried, you know, I tried them myself as a student.”

Dr. Rosalind also indicated a factor that affected her choice of technology tool for her online course. She said,

> Sometimes the software tool will change from the beginning of the semester to the end of the semester, and so, making I cannot just blindly recycle content. I have to make sure that, I’m checking to make sure that the technology tool is still working the same way that it worked when I decided to use it.

In addition, Ms. Cheryl shared her experiences in choosing technology tools. She mentioned Aleks software, which she used for math placement in one of her online courses. She indicated,

> As soon as I’ve used technologies or ideas before that are really confusing and then I get rid of it. You know, like, for example, even within the Aleks software I was talking about earlier, some of the modules were really confusing for students.

Interestingly, Ms. Cheryl mentioned that she tried to answer the question “How can I make this less hard for them?” while selecting technology tools to support interaction in her online courses. This data aligned with the TRM framework (Kopcha et al., 2020) in the process of evaluating and identifying appropriate technology to integrate into online courses. Then, Ms. Cheryl explained the process of making it easier to use the tool. She said,

> We got rid of all the ones that were confusing or were not explained well… We just deleted those out and so… We kept the ones that were really explained well… We got rid

of some of the ones that were just making them [students] frustrated or taking them a long time to get through.

The Implementation of Technology Tools for Online Interactivity

The purpose of this section was to provide information analyzed from the data to answer the research question, "How do instructors use technology tools for online interactivity?" In order to answer this research question, the data collected and analyzed based on the last step of Kopcha et al.'s (2020) framework, which provides the actual implementation and evaluation of technology by instructors. The detailed description of implementing and evaluating technology was provided in the presentation of cases. The data analysis showed instructors' experience with the implementation of technology tools to facilitate online interaction. The following theme was identified from the data analysis: Instructors Incorporate All Four Components of the Theory of Interaction (Hillman et al., 1994; Moore, 1989) in Their Use of Technology Tools.

Theme: Instructors Incorporate All Four Components of the Theory of Interaction (Hillman et al., 1994; Moore, 1989) in Their Use of Technology Tools. There were four categories for this theme: (1) Technology tools support learner-instructor interaction; (2) Technology tools support learner-learner interaction; (3) Technology tools support learner-content interaction; (4) Learners interact with technology. Theories of interaction by Moore (1989) and Hillman et al. (1994) were used as a foundation to explain the four categories.

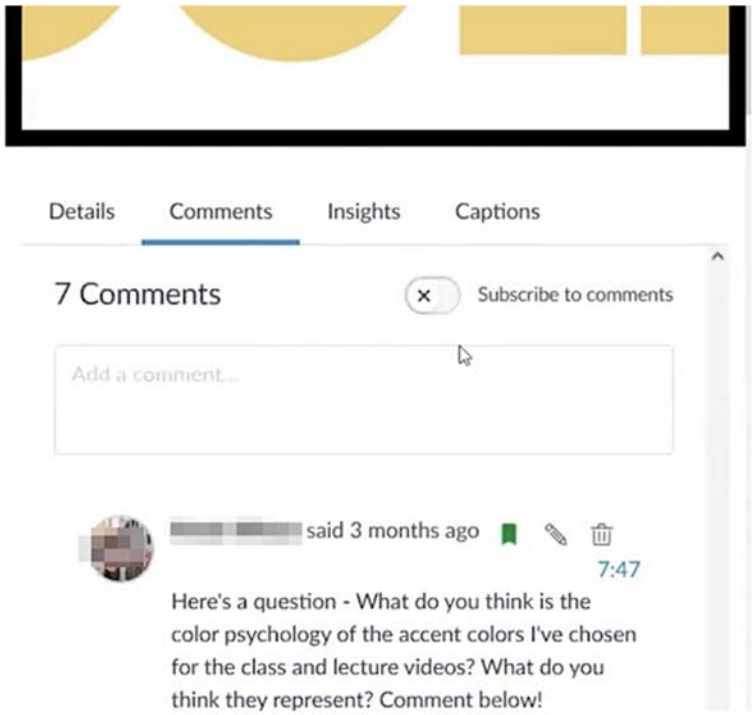
Technology Tools Support Learner-Instructor Interaction. Ms. Karen shared the use of Flipgrid videos, "We're [instructors and students] introducing ourselves, like their crazy videos here. I am in a detective outfit in the store. It's a two-minute video." In addition to Flipgrid, Ms. Karen used Canvas Studio to facilitate learner-instructor interaction. She explained the use of videos in her online course as below.

In some of the videos, you'll see that I've worked questions into the actual video itself so that the students will comment back and forth on... on the video. So, you can see here, like you can see, the different points in the video where students have answered questions that I've commented in [on] the video.

Figure 8 illustrates how Ms. Karen interacted with her students through the use of a video.

Figure 8

Instructor's Comment under a Video in Canvas Studio



Ms. Karen also emphasized the use of technology to promote learner-instructor interaction. She said,

We're running class social media accounts. We try to have some course links here to make it easy for students to get in touch with us. We have a class social media; we have a

class social media account; we have class emails; we have office hours, sign up with a ton of stuff.

Ms. Karen expressed her satisfaction with the implementation of technology to facilitate learner-instructor interaction. She added that "I'm always looking for new ways to... to kind of tweak things and make them better. I have some teams, and we, every semester, we always keep a running list of what to improve every semester."

Dr. Thomas shared he used Canvas Conference to interact with his student. He said, "I have virtual office hours. So, doing these virtual office hours, you [students] have me on camera, you [students] have me also going through the lessons that you had questions that you [students] asked."

Dr. Olivia discussed her experience in applying technology in her online course to promote interaction with her students. In fact, the interaction mostly happened between her teaching assistant (TA) and her students. She said that,

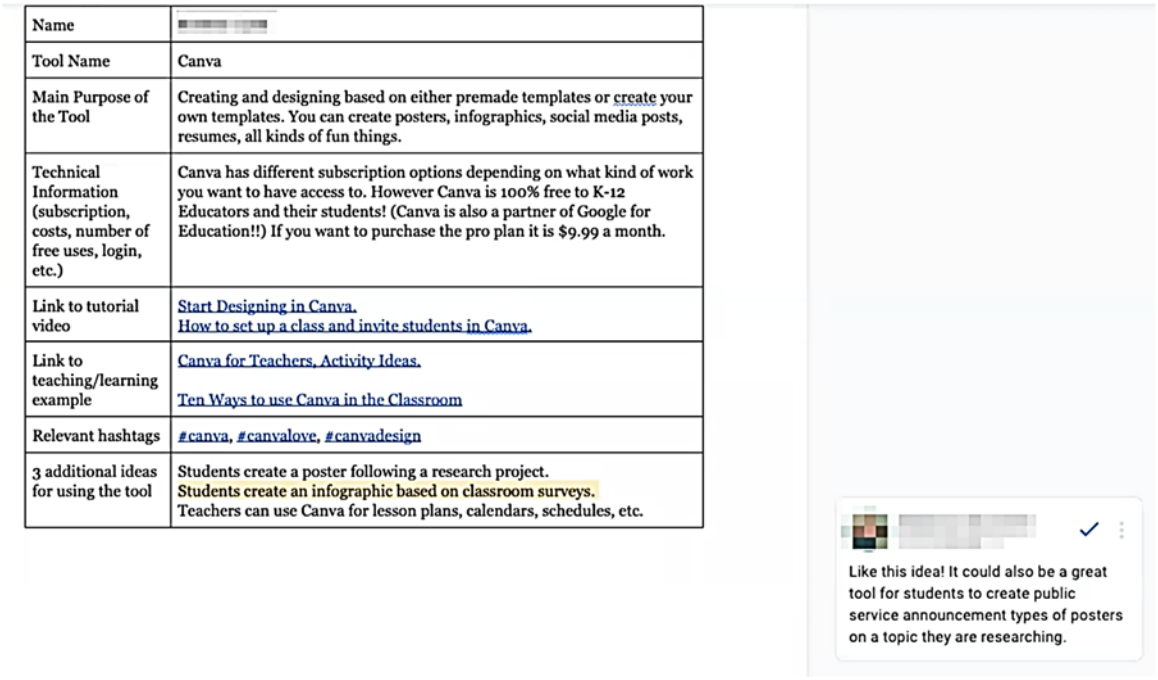
> It was crucial that I had a teaching assistant who did most of it. It's a lot of labor to go through these discussions. Because it requires… in order to use a discussion board, at least in my opinion, in a way that students aren't just like, "oh great," and "fill it out," but to be very active. Like this, the TA had two comments. Probably every day on, you know, check each of these... but she (TA) had the comments, you know, all during the week to try to keep the conversation going. So, I was very pleased with how it went it... it got good feedback, and I thought it was fun."

Dr. Nadia evaluated learner-instructor interaction in her online course as "There were a lot of... they [students] had a lot of good interaction with me." She listed a number of technology tools she chose to facilitate interaction with her students, such as Flipgrid, Google Docs, and Canvas Discussions Board. Figure 9 is an example of how the instructor interacted with her

learners via Google Docs. Dr. Nadia also indicated that “This Edpuzzle is kind of another one where they're interacting with me in the content.”

Figure 9

Instructor Provided Learner Feedback via Google Docs



Name	[redacted]
Tool Name	Canva
Main Purpose of the Tool	Creating and designing based on either premade templates or create your own templates. You can create posters, infographics, social media posts, resumes, all kinds of fun things.
Technical Information (subscription, costs, number of free uses, login, etc.)	Canva has different subscription options depending on what kind of work you want to have access to. However Canva is 100% free to K-12 Educators and their students! (Canva is also a partner of Google for Education!!) If you want to purchase the pro plan it is $9.99 a month.
Link to tutorial video	Start Designing in Canva. How to set up a class and invite students in Canva.
Link to teaching/learning example	Canva for Teachers, Activity Ideas. Ten Ways to use Canva in the Classroom
Relevant hashtags	#canva, #canvalove, #canvadesign
3 additional ideas for using the tool	Students create a poster following a research project. Students create an infographic based on classroom surveys. Teachers can use Canva for lesson plans, calendars, schedules, etc.

Ms. Cheryl explained how she chose Connect, a Mcgraw Hill software, to interact with her students. She said,

> As far as like... interacting with my students, something that I do is I give them a weekly assignment where… where they have to read through the smartbook and answer questions. And sometimes, they get the ones they don't understand where they get wrong. So the ones that they don't understand. I have them submit to me as one of their assignments, and I call them [to] preview questions. This is something else I use, so the technology, I guess, would be like Connect - the smartbook.

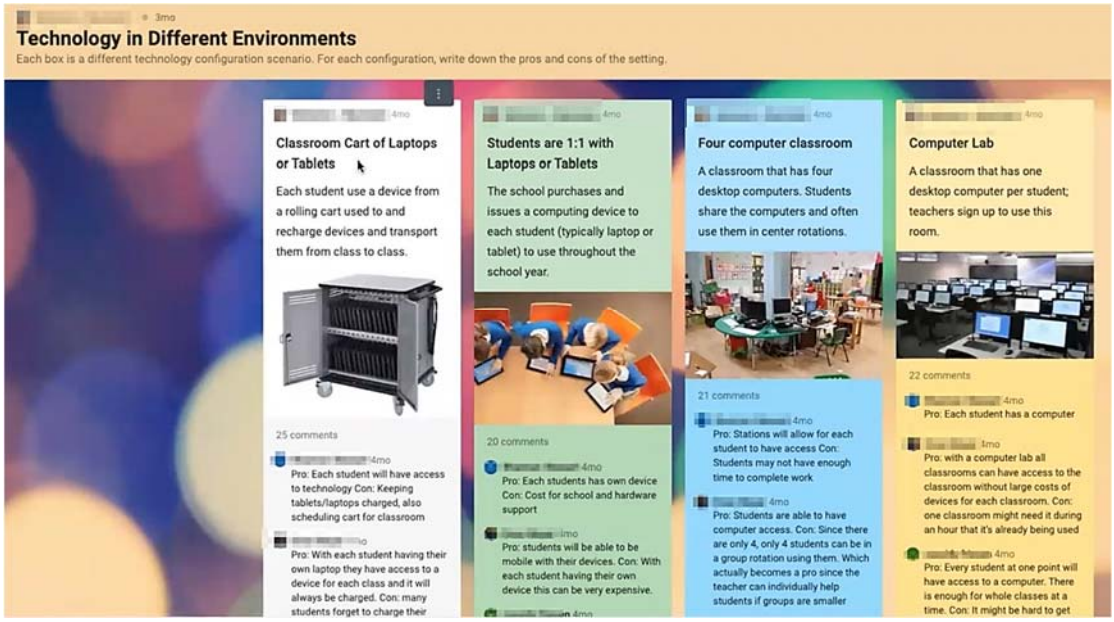
Ms. Cheryl indicated that besides Connect, she used Canvas Discussions Board for learner-instructor interaction. She stated,

I have them upload to Canvas a screenshot of the question that they didn't understand, or they had a problem with. So, for example, this one here they took a screenshot of the question and then they said, “Hey… This is why it was confusing to me or, this is a question that I had” and then either my graduate assistant or I will respond back to them, and explain to them, you know, like… what they did not understand that sort of thing.

Technology Tools Support Learner-Learner Interaction. Both participants 1 and 5 used a Padlet for learners to interact with each other. Ms. Karen said, “Padlet has really helped with that with them interacting with each other.” Figure 10 shows an example of how learners used Padlet to interact with each other. Learners commented on the pros and cons of technology used in various scenarios.

Figure 10

Using Padlet to Facilitate Learner-learner Interaction

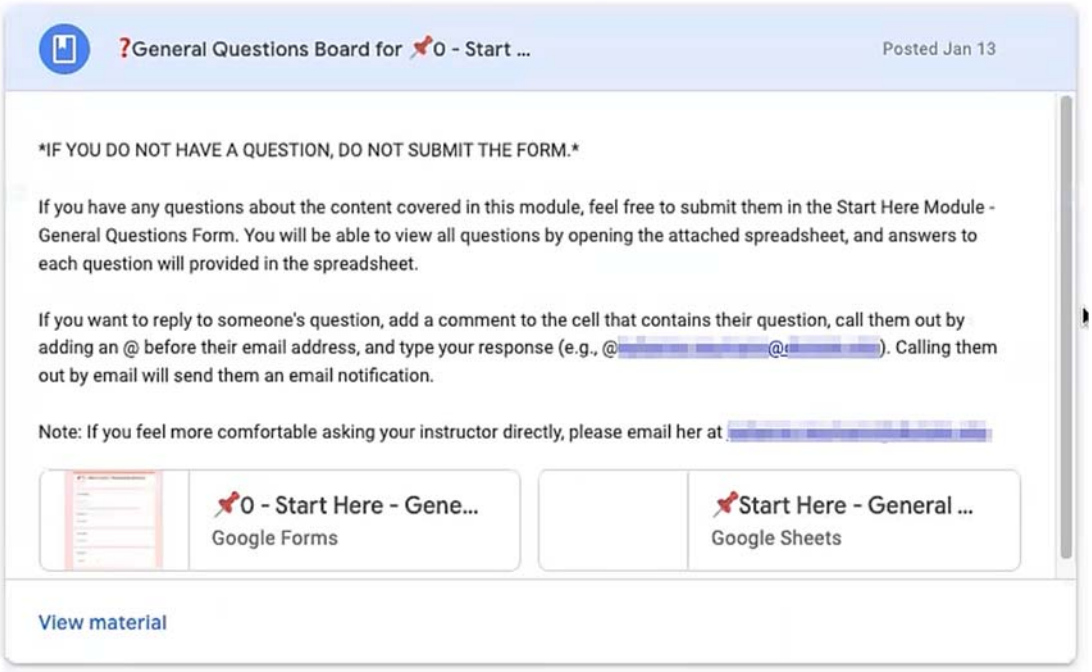


In figure 11, Dr. Nadia also shared how she chose Google Forms to support learner-learner interaction. She said,

I set up these Google Forms for questions. And then, I don't… I don't think anyone has any questions actually in it… but they, so students, could, you know, type in a question and then, ah, answers were kind of, you can respond to people in here. So, kind of just created like a kind of a discussion board platform for anyone who needed some additional assistance with anything, and that and anyone could respond to that whether it was an instructor or a peer.

Figure 11

Using Google Forms to Support Learner-learner Interaction



Although Dr. Nadia used different technology tools to facilitate learner-learner interaction, she said that "I think if I had to do it over again, I would build in... [pause] I would build in more required student interactions with each other."

Dr. Rosalind shared how she used Zoom for learners to interact with each other. She said, I did require them to engage during the Zoom call with a reaction or typing something into the chat or opening their microphone up. As far as interacting with each other, I just

kind of facilitated that conversation [and] tried to make it as similar as I could to a classroom setting when we were all in the same room.

Besides Zoon, Dr. Rosalind chose GroupMe Text for learner-learner interaction. She said, “I encourage interaction in GroupMe. The GroupMe, of course, encourages interaction with each other.” This participant discussed the implementation of technology tools for learners to interact with each other. She said,

> I think I’m satisfied, but I think it could be better. I wasn't consciously focused on students interacting with each other, maybe as much as I could have been, um, because I was more focused on just helping them learn the content. So, I think that's an area I can improve is being more intentional about students interacting with each other.

Ms. Cheryl shared how she implemented a technology tool for learners to interact with each other. She said,

> We use Connect, a Mcgraw Hill software, for their homework assignments. The cool thing with Connect, as you can make the problems algorithmic which means everyone gets the same problem, but they have different numbers like, no one has the same numbers, so they can interact with their classmates online and get help from them, but they can't just copy their answers. Because if they copy their answers, they're using someone else's numbers, and it would be wrong.

Furthermore, Ms. Cheryl added her thoughts on the implementation of Connect in her online course below:

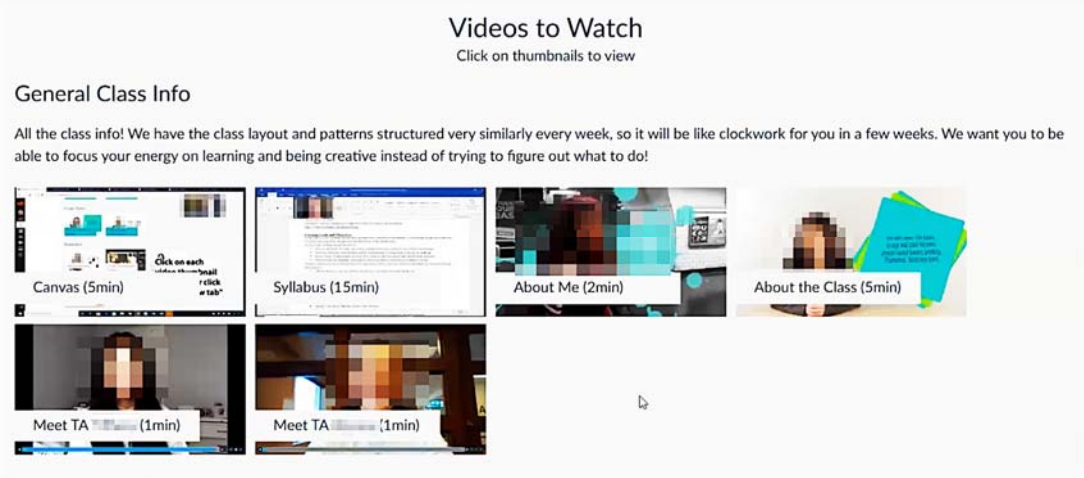
> I really like this technology too, for their homework, because they all have their own sets of numbers, they have to do their own work. But at least they can collaborate with their friends, and they're like, “Okay, well then, what did you do to get to this number” And they can work together and hopefully both of them will really understand it with their own numbers, you know, so I think that helps with the interaction going on.

Technology Tools Support Learner-Content Interaction. Data analyzed from the observation and interviews showed that participants chose various types of technology tools to provide the course content for learners to interact with. Ms. Karen said, "We need to have custom content, either notes pages or videos." Figure 12 provides an example of a list of videos used by Ms. Karen. And then, she stated that,

> We have a lot of technology, like screen capture tutorials, that you can't do…you need videos for that, like on some of this where I want to be able to bring it to life. And also, I want them to have a connection with me and with the class for them to feel like they're getting some like a personal interaction.

Figure 12

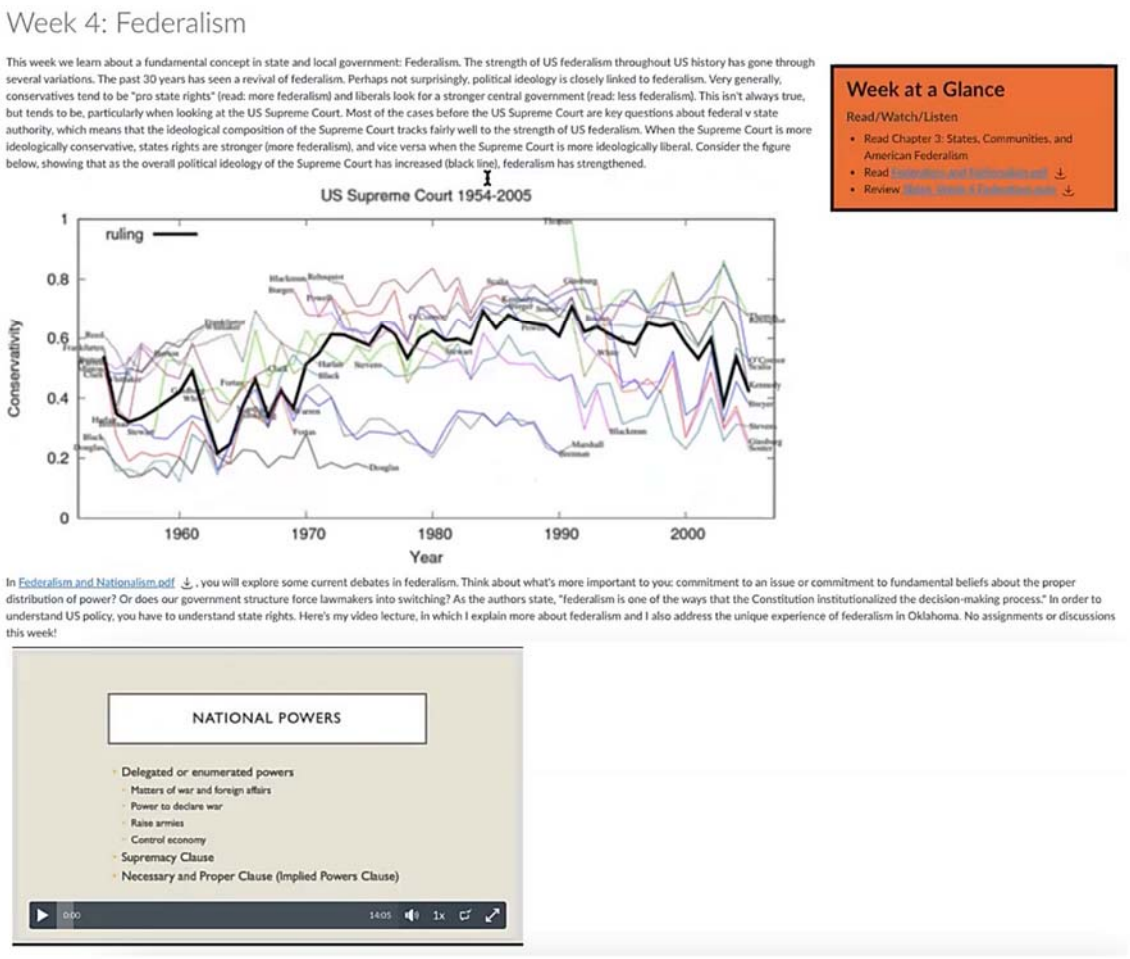
Using Videos in an Online Course



Dr. Olivia talked about how she provided the course content "I just try to think about what an easy way is to do that? and… we're all pretty familiar with this format of reading like a blog post type thing". Figure 13 shows an example of the content presented in an online course, including texts, images, pdf file, and videos.

Figure 13

Providing the Course Content



Dr. Olivia explained the way she presented the content in Canvas LMS. She added both texts and visual materials (i.e., a figure and a video lecture) about the lesson. She also used a small, formatted box with a bright color (orange) and bold texts to highlight the important parts of the related contents. She said,

> Here, I talked about the ways in which the Supreme Court is ideologically associated with Federalism. And then, I give this one's long, 14 minutes… But this is a 14-minute video on Federalism itself. And then, they have to, you know, they have the, the, what to do over here [pointed to the top right corner in her course]. If they don't feel like doing

that, then they can just come here and go right through that [pointed to the text in her course].

In terms of describing the process of choosing technology for learners to interact with the course content, Dr. Nadia indicated that,

> I always try to keep that in mind, so it's not just a video every week, but it's, you know, maybe a video and an infographic, and maybe they're doing, you know, some sort of reading as well. But it's not. But not, well, I hope it's not monotonous. I tried to intentionally make sure that there were different ways to represent the course content, but then, they also… in all of their assignments, they have lots of choices.

In terms of providing the course content, Dr. Rosalind said,

> I'm using a scaffolding approach… where you are either watching the videos, but you have to take it that step further and have them use what they're watching in the videos for it to… to help them make meaning from what they've watched.

Learners Interact with Technology. This category provided information on how learners interacted with the technology that the instructors chose in their online courses. Ms. Karen indicated that,

> We set everything up in pages for both of my courses. We feel like I get really… good responses from students on this, and we're working all the time. I feel like just the interface of even how you design a course is kind of the introduction to how students… how they feel about the course [and] how they interact with it, because if they're frustrated with just even the design part of it. So, every week has this exact same layout. I want to add creativity to what I'm requiring them to do. I don't want every week's format to look the same because if, if they're not confused by the format, then they can go ahead and focus on doing their work.

Then, Ms. Karen expressed her feelings towards how her learners interacting with technology in her online course. She said,

> With the technology, well, I mean that's it, that's kind of a broad question because like I'm satisfied with like 80% of the students interacting. I'm satisfied overall as a whole. I feel like with an asynchronous class where it's completely online, and you have adult students who, and students who are working full-time jobs and working in teams, like you, you can never have… I feel like you never have a class where 100% of the students are… 100% motivated the entire way through.

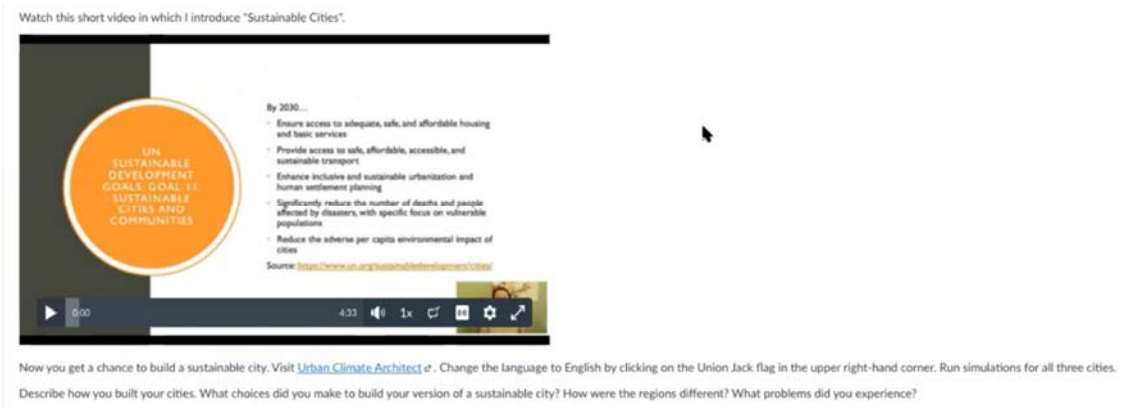
Dr. Geoffrey used a QR code in the online course, which used to be a face-to-face course. He described the course as "a weekend film festival." In that course, he said, "We used technology with a QR code in the face-to-face version, where they would scan their attendance, we would hold up a slip, and they would hold, could scan it." He added,

> You know, to record their attendance at the film festival. Well, of course, this way in this particular one, well, they have 'til midnight of the night that the movies were scanned. So, for example, for the Friday night movies, they could watch both of them, but then they answer the discussion questions which are due, you know, by 11:59 that night. Saturday, they watch four movies, and by midnight of that night they have to complete all of their discussion questions, and then on Sunday, same thing, they have until midnight to answer… the discussion questions.

Dr. Olivia used Urban Climate Architect, a web-based flash game, in her online course. Firstly, she created a discussion board to introduce a concept using a video lecture (Figure 14).

Figure 14

Discussion Board with a Video Lecture

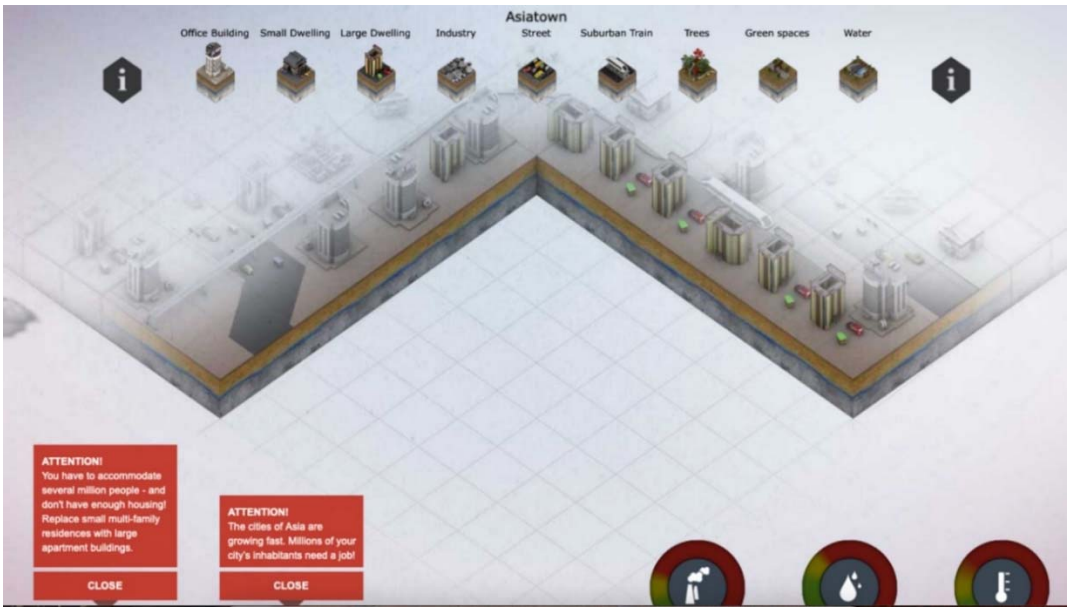


Secondly, Dr. Olivia described how students interacted with the game (Figure 15). In the discussion board, she provided the link to the game and directions to complete the task. She said,

> They [students] get a chance to build a sustainable city, so they go to something called Urban Climate Architect. This is just one thing for this, and they actually have to simulate… They actually have to, you know, simulate building a city by adding on different types of, you know… Here's a train, and here's a tree, etc. And then they build a city, and then they see what happens to their… their CO2 emissions, rain water temperature, etc. And then I asked them to build a city and each of these differences when they call it silly things like Asia town something else, and they have to compare how those regions are different.

Figure 15

Urban Climate Architect – A web-based Flash Game



After describing the activity using Urban Climate Architects, Dr. Olivia evaluated the possibility of using the tool in the future. She indicated that,

> So this is the kind of stuff that I would do with them normally in class, so what I was really thinking about was how do I make this online environment just as interactive and hands-on and applicable as my normal class would be.

Finally, Dr. Olivia expressed her feelings over how students interact with the technology she chose. She said,

> I'm very satisfied with the way that I organized my class in terms of I can look and see how many page views they have, and I know straight away if they even have been trying or if they've been here.

Dr. Nadia provided her evaluation on learner-interface (technology) interaction in her online course. She said that,

For the most part, I was satisfied with how they interacted with everything. A lot of these tools are ones that I know different districts are using and that they've had success with. And so, they were able to do everything that they would have done in our normal face to face class, too.

Ms. Cheryl described how her students interacted with technology that "I created. like, buttons to get them [students] to the different interactive tools that they use in my course." Figure 18 illustrates the buttons that Ms. Cheryl created in her online course that helped students navigate and use the technology tools easier.

Figure 16

Using Buttons to Organize Technology Tools

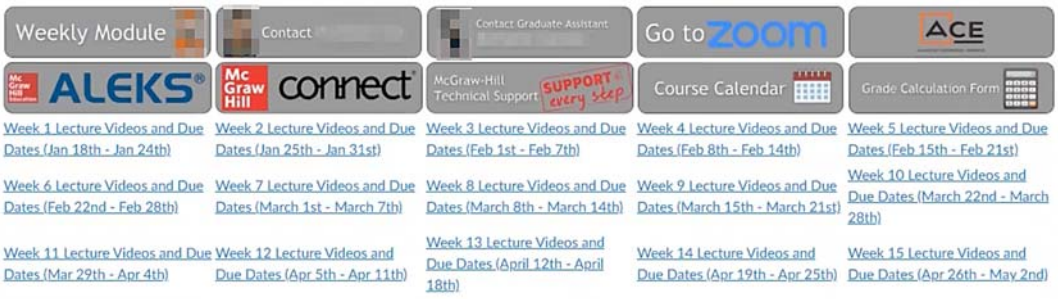


Figure 16 also presents a number of links to videos by Ms. Cheryl. She talked about the choice of videos that "I've gotten a lot of really good, positive feedback from students about the videos because they like being able to pause it."

Challenges When Implementing Technology to Facilitate Online Interactivity

Exemplary instructors discussed the challenges that they faced when implementing technology to facilitate interactivity in their online courses. Ms. Karen said,

One of the issues is a lot of the engagement Apps that I use there in different situations, I probably have about seven that... that I kind of can use in different situations. Everything from Kahoot to like Google Jamboard, like there's several Storyboards, all different ones.

> But there are very specific to one thing, and I really would like something that's more multifunctional.

Dr. Thomas indicated his challenges that, “One of my biggest problems is that I’m not tech-savvy. And so, I... I really need training on how to use the tool effectively sometimes.” He added, “The students are having difficulty signing up for the program because they think it's in Canvas when they’ve got to go somewhere else to sign up for, then it gets linked to Canvas, and it's driving me crazy.”

Dr. Olivia shared her experience, “The challenges with that on any other technology is that it's... it's a heavy lift at the very beginning, and it's a steep learning curve to try to integrate it into what you're already doing.”

Dr. Nadia stated that “I think the biggest challenge is I guess, you know, knowing how it [technology] will [affect] how students will interact with them.” She shared the following challenge of using technology tools. She said,

> I guess the other challenge that I ended up having was just designing the content that they were interacting with through those tools in a way that not only reflects what's going on in K-12 schools but also gets them to interact with the content that they're learning about in class. So, you know, there were times where I designed something and was like… that's really cool, but like no one's doing that in K-12.

Sharing about challenges, Dr. Rosalind indicated the issue she faced as “you know just the challenge that not all students are technologically savvy and can troubleshoot things on their own always can cause some trouble.” And she talked about another challenge relating to the update of the technology. She indicated below

> Sometimes the software tool will change from the beginning of the Semester to the end of the Semester, and so I cannot just blindly recycle content; I have to make sure that I’m

checking to make sure that the technology tool is still working the same way that it worked when I decided to use it.

Dr. Rosalind also mentioned her issue when finding quality technology tools that could have an affordable price for students. She said,

> Other challenges and sometimes tools that you want to use come with the cost. And so, finding quality tools that are not going to add to student costs associated with the course is really important for me. And so, because I'm working within such a tight budget oftentimes.

Additionally, Ms. Cheryl shared her problems when choosing technology; for instance, how to encourage learners complete the video lectures effectively without forcing them to do. She expressed that,

> The biggest... I think the constraint is that these videos are awesome. But the students, I think, sometimes want to try to get by without having to watch the videos. So, it's just extra work, and I can't like force them to. I guess I could give them more quizzes or something like that, but I mean they have homework assignments, and the homework is really hard if they haven't paid attention, you know, to the lecture, so that helps with it a little bit. But I wish there was a way I could like really hold them accountable to watch the videos. Some other constraints, I guess it's hard letting them be able to ask me questions live. Like they have to set up an office hour, or reach out to my GA, or reach out to the Tutoring lab or something if they have a question.

Summary

This chapter presented data collected and analyzed from the individual interviews. The presentation of cases provided detailed descriptions of exemplary instructors, including their teaching information and technology implementation. The findings illustrated what types of technology tools were implemented in online courses for interaction; how exemplary instructors

selected and used such technology tools to facilitate online interaction and interactivity. The group of exemplary instructors in this study demonstrated their knowledge and experiences in integrating technology tools to foster interaction in online courses. The instructors also indicated the issues that they had while implementing technology to promote interactivity. The next chapter, Chapter V, will discuss the findings and implications, and future research.

CHAPTER V

DISCUSSION

The purpose of this dissertation was to explore the implementation of technology tools in online courses to facilitate online interaction and interactivity. This chapter summarizes the significant findings presented in Chapter Four, discusses implications, and provides recommendations for future research. This chapter is divided into four parts: a summary of findings, limitations, implications, and recommendations for future research.

Summary of Findings

In this section, the researcher discussed the findings from the data analysis, which was presented in Chapter Four. The data was collected in the form of observations, interviews, and documents (screenshots). This case study provided in-depth insight into how a group of successful instructors implemented technology to incorporate interaction and interactivity in their online courses. The discussion of the findings was driven by four study questions listed below:

1. What technology tools do instructors choose and use to facilitate online interaction and interactivity?
2. Why do instructors choose to adopt technology tools to facilitate online interaction and interactivity?

3. How do instructors choose technology tools for online interaction?
4. How do instructors use technology tools for online interactivity?

Research Question 1: What Technology Tools Do Instructors Choose and Use to Facilitate Online Interaction and Interactivity?

The findings revealed that the exemplary instructors used a wide range of technology tools in their online courses. Among these tools, 34 technology tools were found to facilitate online interaction and interactivity. The types of technology tools range from LMS tools (i.e., Canvas, Google Classroom), conference tools (i.e., Canvas Conference, Zoom), presentation tools (i.e., Nearpod, Google Slides), social media tools (i.e., Twitter, Instagram), and management tools (i.e., Agorapulse, Basecamp). Zoom, a conferencing tool, is the most commonly used by instructors to support learner-learner and learner-instructor interaction. This finding is similar to the discussion relating to the popularity and interaction support of Zoom in online courses by Gordon (2020), Kohnke and Moorhouse (2020), and Li et al. (2021). Dr. Geoffrey made a compliment about Zoom as an amazing technology. He added, "I made the conscious decision to utilize Zoom exclusively from my online teaching in ah fall and spring semesters."

Many technology tools mentioned in this study are similar to the technology tools reviewed in Chapter Three. For example, asynchronous tools found in this study include Classkick, Canvas Studio, Canvas Discussion Boards, Connect, FlipGrid, pre-recorded videos, Google Tools, and Wix. Synchronous tools found in this study include Canvas Conference, Zoom, and GroupMe Text. In addition, participants in this study used other tools (i.e., Agorapulse, Basecamp, Edpuzzle, and Nearpod) that could be implemented in both online asynchronous and synchronous activities.

The findings also showed that some instructors used a limited number of technology tools in their online courses in order for their learners to focus on the course content rather than

learning to use new technology. On the other hand, most instructors in this study expressed their eagerness to use different types of technology to facilitate online interaction.

Research Question 2: Why Do Instructors Choose to Adopt Technology Tools to Facilitate Online Interaction and Interactivity?

The selection of technology tools to facilitate online interaction and interactivity was affected by many reasons. The findings showed three main reasons, including the ease of using the technology, the purpose of using the technology, and the cost of technology. The exemplary instructors who participated in this study tried to choose technology that is user-friendly to fully facilitate interaction in their online courses. The level of difficulty while using the technology was mentioned as one of the selection criteria. The instructors expressed their belief that familiar or easy-to-use technology increased students' engagement and interaction in their class. This finding is similar to the previous studies that technology tools foster interaction and engagement in online courses (Guo et al., 2018; Mooney et al., 2014).

The instructors indicated that they chose technology tools based on different purposes. The instructors used pre-recorded videos because the videos included a variety of visualization for the content, such as text animation, images, and audio. Kuo et al. (2014) showed that using visuals in online courses fostered motivation and experiences of learners when participating in online interactivity. Instructors reported that they chose technology to assess students' knowledge and interaction. Furthermore, the findings showed that the selection of other technology tools also came from the inadequate functions in the technology provided by the university. For example, Ms. Karen chose Padlet because the Canvas Discussion Boards had some limitations, including issues with downloading, uploading, and reaching out to maximum capacity.

Exemplary instructors preferred free or low-cost technology tools so that their students could have opportunities to use more technology and interact with the course content better. This

finding is consistent with Wang's (2004) discussion that cost affected the choice of technology. So, Wang (2004) suggested finding reduced or low-cost technology to implement in online environments.

The above-mentioned reasons reflect instructors' belief and understanding to choose appropriate technology which satisfies their expectations to use in an online learning environment. The findings demonstrate a similar discussion by Kopcha et al. (2020) relating to the first step of integrating technology from the TRM. That is, "the teacher then draws on beliefs, knowledge, and experience to conceptualize possible uses of technology that support what the teacher considers best in the given context" (p. 736).

Research Question 3: How Do Instructors Choose Technology Tools for Online Interaction?

To facilitate interaction in an online class, the instructors interviewed highlighted the importance of using the technology tools. The findings described instructors' experience in selecting the technology to promote online interaction. Instructors discussed their concerns and other factors that they needed to consider when deciding to choose technology. Instructors expressed their concerns as to whether technology tools support online interaction as well as how they can create simple use of technology in their online courses. Besides, a number of factors that affect the selection of technology tools were mentioned by instructors, such as multipurpose and advantages of technology. This process of finalizing technology tools for online interaction is consistent with the process of making decisions described in the second step of the TRM (Kopcha et al., 2020). According to Kopcha et al. (2020), the decision-making process is "a complex negotiation in which the teacher is trying to answer the question "What is the best…?" (p. 736) to evaluate and select technology.

The findings also revealed that most of the instructors chose technology that supported learner-content interaction, learning outcomes, and engagement. The choice of technology tools

shared by the instructors less supported the interaction between learner-learner interaction. Moreover, few of the instructors selected technology tools to facilitate all four types of interaction discussed by Moore (1989) and Hillman et al. (1994), including learner-learner interaction, learner-instructor interaction, learner-content interaction, and learner-interface interaction.

Research Question 4: How Do Instructors Use Technology Tools for Online Interactivity?

The implementation of technology tools described by the exemplary instructors was presented according to four types of interaction: learner-content, learner-instructor, learner-learner, and learner-interface interaction. The types of interaction were guided by the theories of interaction by Moore (1989) and Hillman et al. (1994).

The instructors in this study showed that they used technology to promote interaction between learner and content by integrating text, pdf files, images, audio, and videos into the course content. This finding is consistent with Moore's (1989) discussion that during the learner-content interaction, learners have opportunities to interact with various materials. In terms of learner-instructor interaction, the instructors often implemented conference tools to facilitate two-way communication described by Moore (1989). According to the findings, learners interacting with each other were not promoted as expected via the use of technology tools. Moore (1989) indicated that learner-learner interaction happened mainly in the discussions. However, more than two instructors indicated that although they implemented discussion boards or group messages, their students interacted just to satisfy the basic requirements. To promote interaction between learners and interface (technology), some of the instructors created several activities for students to interact with the technology. For example, Dr. Rosalind asked students to interact with Agorapulse, a social media management software, and receive certifications to prove their interaction with the software. This learning activity is similar to what Hillman et al. (1994)

explain the interaction between learners and technology. That is, learners show their ability to operate a technology tool to complete an assignment.

In addition to discussing the use of technology tools to promote online interactivity, the groups of instructors revealed their evaluation of the technology and indicated their intention for using the technology in the future. This finding is in line with the last step in the process of integrating technology in the TMR by Kopcha et al. (2020). According to Kopcha et al. (2020), when using technology, an instructor must consider if the activity contributes to the achievement of the instructor's purpose. Then, the instructor reflects on possible solutions for future use of the technology based on the experience. For instance, Dr. Nadia concluded that after using different technology tools, she thought she would include more requirements to facilitate learner-learner interaction if she used the tools again.

Limitations

This dissertation contained two limitations. The first limitation related to the trustworthiness of this study; that is, relating to the member checking technique, only four out of seven participants responded to the return of the interview transcripts. The second limitation was the use of purposeful sampling technique selection of participants, seven instructors who met the requirements and volunteered to participate in the interviews. The third limitation referred to the criteria for exemplary online instructors that were identified by the award at the South-Central University; no other criteria were used to determine excellence in teaching, such as student learning outcomes. The small number of participants for this study might not represent the whole population.

Implications

The purpose of this dissertation was to investigate how a group of exceptional instructors implemented technology tools to promote interaction and interactivity in their online courses. Hence, the findings of this case study inform both theories and practice.

Implications for Theories

The theories of interaction by Moore (1989) and Hillman et al. (1994) provided foundation ideas for interaction and interactivity in the online environment. This study contributed to the interaction theories by describing how exemplary instructors chose and used technology tools to facilitate four types of online interaction, including learner-content, learner-instructor, learner-learner, and learner-interface. Furthermore, the findings from the interview questions and data analysis informed by Kopcha et al. 's (2020) TRM framework demonstrated a thorough understanding of the process of selecting and implementing technology by a group of exemplary instructors. In other words, the TRM (Kopcha et al., 2020) helps explain the reasons why instructors chose technology tools, how they decided to choose technology tools, and how they used those technology tools in their online courses to facilitate interaction and interactivity. Thus, it can be inferred that the Kopcha et al.'s (2020) TRM framework developed for K-12 education can be applied in a higher education setting.

Implications for Practice

The findings from this study contributed to a better understanding of the practices of a group of exemplary online instructors who successfully implemented technology to enhance interaction and interactivity in their online courses. The actual process of implementing technology and the challenges in applying technology in online settings found from the voices of exemplary instructors can benefit those who are new to teaching online. For example, instructors who want to find technology could save time by trying technology tools mentioned in this study.

Those technology tools were implemented successfully to facilitate interaction in online courses. In addition, instructors who want to integrate technology to promote interaction and interactivity could estimate what to anticipate when selecting and using technology, and how to choose and use technology tools based on the experience of exemplary instructors.

For those who support online instructors (e.g., instructional designers/specialists and technology staff), the data and discussion from this study could help create strategies and methods for professional development activities. For example, future webinars and mini-workshops for new online instructors should be organized regularly (e.g., once every two months) to discuss and review up-to-date technology that facilitates online learning. Along with the reviews, demonstrations of applying such technology in real contexts should be provided for online instructors. Another implication for practice is the use of the TRM framework (Kopcha et al., 2020) as a basis for a faculty professional development session. According to Kopcha et al. (2020), the TRM can scaffold faculty reflection on practice as they evaluate their own decisions when choosing and using technology as well as their process of decision-making.

The study is also important to increase instructors' knowledge of methods that make online education more interesting and participatory. Describing success stories from exemplary online instructors is useful both now and, in the future, as online learning becomes more and more popular.

Implications for Research

The case study method used in this study provided a deeper understanding of the exemplary instructors' implementation of technology. Based on the information gathered and analyzed for the study, there are several recommendations for future research. First, the findings from this qualitative case study were collected and analyzed mainly from individual interviews. A follow-up quantitative study will extend the findings in this qualitative study and provide

recommendations for professional development activities. Second, this qualitative case study was conducted at one university in the South-Central region of the United States with a sample size of seven exemplary online instructors. A replication study in future research should be conducted in different universities to see if there are any similarities in findings compared with this current study. Finally, future research might recruit students as participants to investigate their interactions and experiences with the choice and use of technology in online courses. Possible research questions for a future study might focus on asking (1) what types of technology tools do students prefer to support their interaction in online courses, (2) how do students describe their interaction using the technology tools in online courses, and (3) what are students' expectations towards the implementation of technology to improve interaction and interactivity in online courses.

Conclusion

This case study explored the implementation of technology to facilitate interaction and interactivity in online environments. This study interviewed a group of instructors who were nominated for the 2020 Online Teaching Excellence Award at the South-Central region university in the United States. Overall, instructors described their actual process of selecting and practicing technology to promote different types of interaction (i.e., learner-content, learner-instructor, learner-learner, and learner-interface interaction) in their online courses. Instructors reflected their beliefs, knowledge, as well as experiences in deciding and evaluating types of technology to enhance online interaction. The findings of this study bring an insight into how online instructors integrate technology into their courses. This study is valuable to provide examples for new online instructors and even instructors who are teaching online because of some emergency situations. This study also benefits online instructors who devote their time and energy to creating interactive courses.

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APPENDICES

APPENDIX A: IRB APPROVAL – PILOT STUDY

Oklahoma State University Institutional Review Board

Date:	04/03/2019
Application Number:	ED-19-40
Proposal Title:	The use of technology to facilitate interaction between students and instructors
Principal Investigator:	Thanh Do
Co-Investigator(s):	
Faculty Adviser:	Penny Thompson
Project Coordinator:	
Research Assistant(s):	
Processed as:	Exempt
Exempt Category:	

Status Recommended by Reviewer(s): Approved

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in 45CFR46.

This study meets criteria in the Revised Common Rule, as well as, one or more of the circumstances for which continuing review is not required. As Principal Investigator of this research, you will be required to submit a status report to the IRB triennially.

The final versions of any recruitment, consent and assent documents bearing the IRB approval stamp are available for download from IRBManager. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be approved by the IRB. Protocol modifications requiring approval may include changes to the title, PI, adviser, other research personnel, funding status or sponsor, subject population composition or size, recruitment, inclusion/exclusion criteria, research site, research procedures and consent/assent process or forms.
2. Submit a request for continuation if the study extends beyond the approval period. This continuation must receive IRB review and approval before the research can continue.
3. Report any unanticipated and/or adverse events to the IRB Office promptly.
4. Notify the IRB office when your research project is complete or when you are no longer affiliated with Oklahoma State University.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact the IRB Office at 405-744-3377 or irb@okstate.edu.

Sincerely,

Oklahoma State University IRB

APPENDIX B: INTERVIEW QUESTION PROTOCOL

Date:

Start time:

End time:

Participant Pseudonym:

DEMOGRAPHICS QUESTIONNAIRE

- Center/ Department/ College
- Current Position/ Title:
    - Adjunct professor
    - Assistant professor
    - Associate professor
    - Professor
    - Other.....
- Years of teaching experience:
- Years of teaching online courses:
- Numbers of online courses have taught:

INTERVIEW QUESTIONNAIRE

When answering the following questions, please think about ONE online course you taught that successfully integrated technologies to facilitate interaction and interactivity. If possible, please show your course using the "Screenshare" function in Zoom and I would like to take some screenshots from your course.

Question 1. Please talk a little bit about how you chose technology to facilitate interaction between you and your students.

- What were you thinking about when you made that decision?
- Once you'd chosen the technology, how did you use it?
- Were you satisfied with the implementation of technology tools on the levels of interacting with your students? Why or Why not?

Question 2. Please talk a little bit about how you chose technology to get your students to interact with each other.

- What were you thinking about when you made that decision?
- Once you'd chosen the technology, how did you use it?
- Were you satisfied with the implementation of technology tools on the levels of getting

  your students to interact with each other? Why or Why not?

Question 3. Please talk a little bit about how you chose technology to provide course content or instructional materials/ activities.

- What were you thinking about when you made that decision?
- Once you'd chosen the technology, how did you use it?
- Were you satisfied with the implementation of technology tools on the levels of getting

  your students to interact with the content? Why or Why not?

Question 4. Please talk a little bit about how your students use technology tools in your online course. Were you satisfied with how your students interact with the technology? Why or Why not?

Question 5. When selecting technology tools to use in your online course, what would you like to provide for your students in an ideal world?

Question 6. What are some major challenges and constraints you faced when selecting and implementing technology tools to facilitate interactions in your online course? What did you do to solve the problem(s)?

Question 7. Are there any other technology tools you have not talked about yet that you used to facilitate online interactions?

- How did the technology work?
- What did you want to change?

Question 8. What is your overall feeling about the way you have implemented technology tools for fostering interaction in your online course?

Question 9. Do you have any comments, thoughts, or suggestions to better use technology tools for interactions in your online course? What advice would you give to instructors who want to integrate technology tools in their online courses?

Question 10. Do you have anything you would like to add or share that we have not discussed today?

Possible follow-up interview question: When selecting technology tools to use in your online course, have you asked yourself questions like "What is the best for you and your students to enhance/ extend/ engage/ and effectively facilitate interactions, and how can technology help?"

- If yes, what are your answers?
- If not, why?

APPENDIX C: INFORMED CONSENT FORM

Department of Educational Technology

PARTICIPANT INFORMATION FORM

Investigation of the Implementation of Technology Tools to Facilitate Online Interaction

Background Information

You are invited to be in a research study of investigating the implementation of technology tools to facilitate online interaction and interactivity. We ask that you read this form and ask any questions you may have before agreeing to be in the study. Your participation in this research is voluntary. There is no penalty for refusal to participate, and you are free to withdraw your consent and participation in this project at any time. You can stop the interview at any time.

This study is being conducted by: Thanh Do, Learning, Design and Technology, College of Education and Human Sciences, Oklahoma State University, under the direction of Dr. Penny Thompson, Associate Professor, Learning, Design and Technology, College of Education and Human Sciences, Oklahoma State University.

Procedures

If you agree to be in this study, we would ask you to do the following things: you will be contacted by email and the researchers will conduct the interviews through an online conferencing software (e.g. Zoom). This interview will be recorded, transcribed, and then deleted. You may be asked to show one of your online courses and share some screenshots of the course.

Participation in the study involves the following time commitment: the interview will take about 45 minutes of your time.

Compensation

You will not receive direct compensation for participating in this study.

Risks

There are no known risks associated with this project that are greater than those ordinarily encountered in daily life.

Confidentiality

The information that you give in the study will be handled confidentially. Your information will be assigned a code number/pseudonym. The list connecting your name to this code will be kept

Approved: 05/06/2021
Protocol #: IRB-21-220

in a locked file. When the study is completed and the data have been analyzed, this list will be destroyed. Your name will not be used in any report.

We will collect your information through interviews, audio recordings, video recordings, and screenshots. This information will be stored in a password-protected computer. When the study is completed and the data have been analyzed, the code list linking names to study numbers will be destroyed. This is expected to occur no later than January 2022. The audio/video recording will be transcribed. The recording will be deleted after the transcription is complete and verified. This process should take approximately 6 months. The latest date that recordings will be deleted is estimated by December 2021.

The research team works to ensure confidentiality to the degree permitted by technology. It is possible, although unlikely, that unauthorized individuals could gain access to your responses because you are responding online. However, your participation in this online survey involves risks similar to a person's everyday use of the internet. If you have concerns, you should consult the survey provider privacy policy at https://zoom.us/privacy.

Contacts and Questions

The Institutional Review Board (IRB) for the protection of human research participants at Oklahoma State University has reviewed and approved this study. If you have questions about the research study itself, please contact the Principal Investigator, Thanh Do, at 405-334-9591, thanhtd@okstate.edu, or contact my advisor, Dr. Penny Thompson, at (405) 744-8042, penny.thompson@okstate.edu. If you have questions about your rights as a research volunteer or would simply like to speak with someone other than the research team about concerns regarding this study, please contact the IRB at (405) 744-3377 or irb@okstate.edu. All reports or correspondence will be kept confidential.

Statement of Consent

I have read the above information. I am 18 years of age or older and hereby grant the researcher designated above from Oklahoma State University (OSU) permission to photograph, audio record, and/or videotape my voice and likeness and to use my voice and likeness in photograph(s), audio recordings, and/or videotaping as part of the above titled IRB approved research study.

I give permission for the researcher to distribute and/or use any photograph(s), audio recording(s), and/or videotape(s) made as part of this research project in research presentations, publications, for educational uses, or through any other venue as long as my name is not used.

Approved: 05/06/2021
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All media will become the property of OSU. I will make no monetary claim against OSU for the use of the photograph(s), audio recording(s), and/or video recording(s).

I have had the opportunity to ask questions and have my questions answered. I consent to participate in the study.

I give consent for my data to be used in future research studies:
___Yes ___No

I give consent to be contacted for follow-up in this study or future similar studies:
___Yes ___No

Signature:_____ Date: _____

Signature of Investigator:_____ Date: _____

If you agree to participate in this research, please use an electronic signature on the Adobe document; OR you can print the form, sign, and scan it. Please reply to the invitation email to return the signed consent form.
If you do not have access to Adobe software or a scanner, you can reply to the invitation email and provide consent by including a statement in your email to the researcher, sent from their OSU account, that says "I have read the consent form provided and I agree to participate in the study."

APPENDIX D: RECRUITMENT EMAIL

Email Subject: Dissertation Research Survey Request - Implementation of Technology Tools to Facilitate Online Interaction

Dear ...,

I am a doctoral candidate in the Learning, Design, and Technology program, and am doing a dissertation in the area of online learning. I am contacting you because you are identified as a highly successful online instructor in your college. I would like to invite you to participate in a research study titled ***Investigation of the Implementation of Technology Tools to Facilitate Online Interaction*** *(IRB approval number: ...)*.

This study will explore the decisions and practices of a group of outstanding instructors to increase the knowledge of how they use technology to promote interaction and interactivity in their online courses. The result of this study can then establish the foundation for future research as well as professional development interventions to help all faculty become better online instructors.

Participation is completely voluntary and you may withdraw from the study at any time. For this study, you will be participating in an interview using videoconferencing software (e.g. Zoom) which will take around 45 minutes of your time.

If you are interested in participating in this study, please read the attached Participant Information Form in this email. Then reply to this email to schedule the interview.

If you have any questions, please contact me at

Thanh Do (PI), 121 Nancy Randolph Davis, Oklahoma State University, Stillwater, OK 74078, thanhtd@okstate.edu

Or contact my advisor at

Penny Thompson (Associate Professor), 210 Willard Hall, Oklahoma State University, Stillwater, OK 74078, penny.thompson@okstate.edu

Thank you for your time and participation,

Approved: 05/06/2021
Protocol #: IRB-21-220

APPENDIX E: IRB APPROVAL

Oklahoma State University Institutional Review Board

Date:	05/06/2021
Application Number:	IRB-21-220
Proposal Title:	INVESTIGATION OF THE IMPLEMENTATION OF TECHNOLOGY TOOLS TO FACILITATE ONLINE INTERACTION
Principal Investigator:	Thanh Do
Co-Investigator(s):	
Faculty Adviser:	Penny Thompson
Project Coordinator:	
Research Assistant(s):	
Processed as:	Exempt
Exempt Category:	

Status Recommended by Reviewer(s): Approved

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in 45CFR46.

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2. Submit a request for continuation if the study extends beyond the approval period. This continuation must receive IRB review and approval before the research can continue.
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Sincerely,

Oklahoma State University IRB

VITA

Thanh Thi Phuong Do

Candidate for the Degree of

Doctor of Philosophy

Dissertation: INVESTIGATION OF THE IMPLEMENTATION OF TECHNOLOGY TOOLS TO FACILITATE ONLINE INTERACTION

Major Field: Learning, Design and Technology

Biographical:

Education:

Completed the requirements for the Doctor of Philosophy in Learning, Design and Technology at Oklahoma State University, Stillwater, Oklahoma in May, 2022.

Completed the requirements for the Master of Arts in English at Vietnam National University, Hanoi, Vietnam in 2012.

Completed the requirements for the Bachelor of Arts in Language Education in English at Thai Nguyen University of Education, Thai Nguyen, Vietnam in 2008.

Experience:

Graduate Research Associate at Oklahoma State University, Stillwater, Oklahoma from 2018 to 2022

Professional Memberships:

American Educational Research Association (AERA)
Association for Educational Communications and Technology (AECT)
Educational Media and Technology Student Association (EMTSA)