ONLINE STUDENTS’ EXPERIENCES WITH VIRTUAL REALITY:
AN INTERPRETATIVE PHENOMENOLOGICAL ANALYSIS

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Kathleen Michelle Ross

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Abstract

Online learning has grown rapidly over the past decade in higher education. In 2019, 2.8 million higher education students were learning online, a 129.1% growth from 2018 (Straut & Boeke, 2020). Technology allows students from all over the world to learn, which has aided in the enrollment growth of online learning. Technological innovations have transformed education in the way that content is delivered. The purpose of this study was to explore the lived experience of virtual reality for online students. Three research questions guided the qualitative study to understand how virtual reality impacted online students’ connections to the course structure, feelings of autonomy, and interaction with peers and teachers. The findings indicated that virtual reality enhanced the learning experience for online students. This study's findings can guide policy makers, administrators, and teachers when implementing immersive technology in online learning.
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Chapter 1: Introduction

The purpose of this phenomenological study was to explore the lived experience of virtual reality for online students enrolled in a game design bachelor’s degree program located in the southeastern United States. Virtual reality (VR) is defined as a simulated three-dimensional (3D) experience that immerses participants in an interactive environment that incorporates visuals, physical movement, and text or speech communication (Huang & Liaw, 2018; Ludlow, 2015). For this study, transactional distance referred to the dialogue, structure, and learner autonomy that described the teacher–learner relationship resulting from the separation of time and space (Moore, 1997). Augmented reality (AR) is defined as a computer-generated image superimposed on a user’s view of the real world. Knowledge generated from this study is expected to inform educators, administrators, and government officials in education to help them understand the value of creating engaging online learning environments based on online students’ perspective.

The chapter begins with a brief overview of the research related to online learning and instructional design to provide the context and background of the study. The rationale and importance of the study are discussed next, drawing connections to potential beneficiaries of the work. The research problem, purpose statement, and research questions are presented to focus and ground the study. Finally, the theoretical framework that serves as a lens for the study is introduced and explained.

Context and Background

The process of providing knowledge to society has been traced back to prehistoric times with cave people using rock and clay to communicate information. Fast forward, and 100 years later, education is at the cusp of changes based on the fifth industrial revolution, with technology
available and affordable to revolutionize the classroom using VR, AR, and big data (Huang & Liaw, 2018; Lee et al., 2017; Makransky & Lilleholt, 2018). Those in the education field have the ability to play a role in how education evolves with emerging technology. However, understanding the historical ties to change in education, the role of technology acceptance among those in education, and the developed software is essential to modernizing education and connecting the 21st-century student to learning in an online environment.

Technology allows students from all over the world to learn, which has aided in the enrollment growth of online learning. From fall 2015 to fall 2016, online enrollment grew by 5.6% in the United States, marking the 14th straight year of growth in distance education (Seaman et al., 2018). In 2019, 2.8 million higher education students were learning online, which is a 129.1% growth from 2018 (Straut & Boeke, 2020). The growth of online education has left universities grappling with the high percentage of students who did not complete an online degree compared to students seeking a face-to-face degree (Bollinger & Halupa, 2018; Gregori et al., 2018; Radovan, 2020). Modern technology has been sought out by educators and policy makers as a way to bridge the gap in dropout rates between synchronous and asynchronous learning. VR has been implemented in educational settings with little evidence regarding online students’ experiences of VR and their perceptions of how VR influences their learning experience (Kim & Ke, 2016; Makransky & Lilleholt, 2018; Webster, 2016).

The current literature on the connection between VR and learning highlights the power behind such an innovative learning space. Lessons taught in VR have been connected to an increase in students’ cognitive understanding of difficult topics when compared to learning facilitated through reading assignments (Yoon et al., 2017). Virtual learning environments (VLEs) accessed in VR increase a sense of community among students through avatars and
communication tools (Economou et al., 2017). VLEs utilize a student-centered learning approach, allowing students to experience the course content through a first-person lens, which increases student engagement and motivation (Ludlow, 2015).

Researchers have examined the relationship between online learning and components related to gamification techniques to show how a learning environment that is interactive and personal to a student enhances the connection between the content and the student (Davis et al., 2018; Ludlow, 2015; Syal & Nietfeld, 2020). However, little attention has been given to how VR in distance education can enhance the learning environment and decrease the psychological space for the learner. The purpose of this research study was to explore how VR impacts online students’ connection to the course structure, feelings of autonomy, and interaction with both peers and teachers.

The Significance of the Problem

Online learning has grown rapidly over the past decade in higher education. The online learning model is essential to the long-term strategy of education, with over 70% of colleges and universities offering online learning in 2018 (Seaman et al., 2018). In addition, pedagogical and technological innovations have transformed education in the way that content is delivered and the way courses are managed. However, online course design continues to struggle with decreasing the transactional distance between teacher and student, student and student, and student and content (Bollinger & Halupa, 2018). The lack of connection that students feel with the teacher, classmates, and structure of the course impacts their academic performance (Falloon, 2011; Hoey, 2017; Rovai, 2002).

The private sector is expected to provide 2.6 trillion dollars to emerging technology in education by 2035, with at least 15 million educational users by 2025 and 60% growth in
emerging technology by 2021 (Bellini et al., 2016). This influx of money is predicted to be the catalyst to move education and entertainment into the digital revolution. However, the private sector is focused on funding, leaving a gap between the educational purchase of the technology and its implementation in learning environments.

Online enrollment continues to rise with the growth of technology in education (Dumford & Miller, 2018; Gregori et al., 2018; Shaw et al., 2016). Online learning allows more students to access the Internet from rural areas, and those who work full-time have the ability to take online classes to obtain a degree (Ferguson, 2020). However, online dropout rates are higher than in face-to-face classes by 10%–20% (Christensen & Spackman, 2017; Radovan, 2020). The difference between the two learning environments is found in the lack of culture, motivation, online pedagogy, and the capabilities of the learning management system (LMS), all of which are given as reasons for the difference in dropout rates (Christensen & Spackman, 2017). Other studies have found that self-discipline, level of interaction with faculty members, time management, and learner interaction with a community play a large role in dropout rates in the online environment. A face-to-face learning environment naturally creates a collaborative and engaging environment that forces time management upon a student by requiring the student to be at a certain place at a certain time to focus on a given topic. The campus environment allows for ease of student–teacher and student–student communication (Dumford & Miller, 2018; Manning-Ouellette & Black, 2017). While campus completion rates are higher, online students have been found to learn more and retain information at a higher rate based on the ability to process and intake information on their own time (Manning-Ouellette & Black, 2017).

The ownership of implementing VR in education is in the hands of policy makers, administrators, and educators. Policy makers and administrators are grappling with the
organizational change that is required with a project of this size and scale and the need to ensure educators are properly trained to support the implementation of technology in learning. Educators will need assistance with the development of curricula to support VR in the learning space. Policy makers, administrators, and educators are all responsible for understanding how to balance the cost of the technology that students will be required to pay for the tools with the value of how it enhances learning and can be leveraged to decrease the transactional distance for online students.

Many higher education institutions have not updated their information technology systems since the 20th century and are working to increase budgets to provide room for technology advancement related to systems information structure to support the bandwidth needed to maximize the technology advancement that will enhance online learning (Grajek, 2018). With the increase of technology used in higher education, students will be asked to purchase emerging technology tools to meet the demands of a 21st-century education, increasing their costs and therefore the amount of financial aid they will need to cover additional learning costs.

A qualitative study that explicitly addresses the connection between VR and the impact it has on distance education will allow policy makers, administrators, and teachers to make informed suggestions and decisions based on empirical research to understand how VR can impact learners in distance education.

Research Problem

Over the years, immersive technology such as VR has been adapted to enhance learning and provide an interactive learning experience (Madden et al., 2020; Radianti et al., 2020; Yeh et al., 2020). The number of VR and AR applications is expected to grow 60% by 2021, with an
estimated 15 million educational users expected by 2025 (Resnick, 2017). Private companies continue to move funds into the education sector to revolutionize learning and aid in the growth of online learning (Gay & Betts, 2020; Bellini et al., 2016). In 2019, 2.8 million students were learning online, which is a 129.1% growth from 2018 (Straut & Boeke, 2020). While VR dates back to 1957, the connection to how the tool is used in a learning capacity for distance education has not been thoroughly researched (McFaul & FitzGerald, 2019). Research studies have focused on the connection between learning and VR in the campus environment and have demonstrated positive outcomes. However, the online students’ lived experiences have not been studied to understand how VR decreases the transactional distance for students. Researchers have examined the relationship between online learning and components related to gamification techniques to show how a learning environment that is interactive and personal to a student enhances the connection between the content and the student (Davis et al., 2018; Ludlow, 2015). As online learning continues to grow, educators and leaders need to understand how VR impacts the student experience from the learner’s lens to create a student-centered online learning environment.

Central Research Question

The purpose of this research was to explore the connection between VR and transactional distance on student learning in distance education through a qualitative interpretative phenomenological analysis (IPA) study. The study was guided by the following overarching central research question:

What are the experiences of online students enrolled in a Bachelor of Science degree program who utilized virtual reality?
Sub-Question: How does virtual reality impact online students’ connection to the structure of the academic course?

Sub-Question: How does virtual reality impact online students’ feelings of autonomy?

Sub-Question: How does virtual reality impact online students’ interaction with both peers and teachers?

Definitions of Key Terminology

For this study, the key terms are defined as follows:

**Virtual Reality:** Simulated 3D experience that immerses participants in an interactive environment that incorporates visuals, physical movement, and text or speech communication (Huang & Liaw, 2018; Ludlow, 2015).

**Augmented Reality:** A computer-generated image superimposed on a user’s view of the real world.

**Virtual Reality Learning Environment:** Simulated 3D experience that immerses participants in a classroom that is interactive and incorporates a lesson plan, guided instructions, and auditory feedback.

**Online Learning:** Learning that takes place at a distance from a physical academic institution and a traditional classroom. Interaction with the teacher is conducted through video, phone, or audio conference or email. Course material is delivered through a learning management system.

**Transactional Distance:** The psychological or communicative space that separates instructor from learner in the interaction between them, occurring in the structured or planned learning situation (Moore, 1997).

**Dialogue:** The interactions that take place between the learner and teacher internally and externally (Moore, 1997).
Structure: The extent to which course goals and objectives are pre-prescribed, the nature of course assignments, and the ability of the course to accommodate individual online student needs (Zhang, 2003).

Learner Autonomy: The learner’s sense of self-direction and control over learning, which is affected by dialogue and the flexibility of course design and delivery.

Immersive: The action of seeing, hearing, and interacting in a nonphysical space that mirrors a real-world environment and appears to surround the user.

Student-Centered Learning: Learners are active participants in their learning process by incorporating their interest and skill in the learning experience.

Gamification: A set of learning activities that use game-design elements of badges, scores, and story to encourage user interaction with course content.

Learning Management System: Web-based technology that can deliver educational courses and curriculum, provide communication, and receive information uploaded by the user.

Multimedia: A combination of audio, text, images, videos, animation, and interactive content to communicate information.

Emerging Technology: Any technology that is developing from existing technology and software.

Avatar: A figure that represents a human in an interactive online environment such as video games, learning spaces, or Internet forums.

Perceived Ease of Use: The degree to which a person believes that using a particular system will be free from effort (Davis, 1989).
Technology Acceptance Model: The technology acceptance model is a theory for an information system that evaluates the users’ perceived usefulness of a tool and its perceived ease of use (Davis, 1989).

Head-Mounted Display: A device worn on the head of a user that has a display that covers the eyes with an optic display in front of each eye to display computer technological information.

Learning Styles: Characteristic cognitive, affective, and psychosocial behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment (Curry, 1981).

Technology Agility: The ability to quickly and smoothly adapt to new forms of technology, software, and hardware.

One-to-One Computing Initiatives: Academic institutions that provide enrolled students a computer outfitted with software, hardware, and digital course material.

Cybersickness: Symptoms of physical discomfort that can include nausea, disorientation, and eye strain related to using virtual reality.

Mixed Reality: A combination of virtual and physical elements that participants can interact with simultaneously.

The following section of this chapter will include a description and discussion of transactional distance, which will serve as the theoretical lens for this study.

Theoretical Framework

The theoretical framework that informed this study is transactional distance theory (TDT). TDT was developed by Michael Graham Moore in 1997 in his study of student-to-student, teacher-to-student, and student-to-content relationships in distance education through dialogue, course structure, and student autonomy. TDT has been utilized by researchers in the
field of distance education (Armellini & De Stefani, 2016; Giossos et al., 2009). TDT encompasses the student behaviors associated with learning online and serves as a guide for researchers on how to enhance the online learning environment through the voices of the students (Falloon, 2011).

Moore’s creation of theoretical frameworks focused on understanding the online learning environment dating back to the 1950s by researcher Borje Holmberg. Holmberg developed three constructs to make sense of the online learning environment in order to understand what one can expect from distance education in relation to the conditions, circumstances, and practices (McIsaac & Gunawardena, 2001). These three constructs are independence and autonomy, industrialization of teaching, and interaction and communication. Moore extended Holmberg’s constructs based on the shared responsibilities of learning and teaching and the need to develop a learning environment that supports independent study.

TDT falls within the constructivist paradigm and connects to the importance of creating an authentic learning environment, which is a required condition for learning (Lee & Huang, 2018). The TDT uses the psychological space between the student, teacher, and content to determine the varying ways to use structure and dialogue to shift the focus of control from the teacher to the student to develop an autonomous learner (Gokool-Ramdoo, 2008). Moore (1997) defined psychological space as the transactional distance influenced by three factors: (1) the dialogue between teacher and student and between student and student, (2) the structure of the learning environment, and (3) the autonomy in which the learner has the ability to control the learning procedures (Giossos et al., 2009).

The first component of TDT is focused on dialogue, emphasizing the student–student and student–teacher interactions. The second component is established through the structure of the
course and how the design can foster a relationship between student, teacher, and classmates.

The third component, autonomy, is emphasized through the first and second component of TDT. Autonomy of the online learner is enhanced when the structure of the online course for students can be completed asynchronously while also ensuring multiple ways for student interaction and teacher communication. All three factors of TDT play an important role in how VR can decrease the feelings of distance between the students and between students and teacher.

**Dialogue**

The communication structure in online learning is developed through a variety of media; however, the term “dialogue” refers to the interactions that take place between the learner and teacher internally and externally (Moore, 1997). The course materials, assignment feedback, and discussion boards are the tools that increase the dialogue within an online course. Moore highlighted that the dialogue includes the internal interaction that takes place when an online student is reviewing course materials and recorded course lectures. A more dynamic dialogue structure is developed through instructor feedback, timely email correspondence, and discussion boards. Instructor personality and learner personality also influence the development of dialogue that takes place in a course (Falloon, 2011). The teacher has to engage the learner in dialogue by actively participating in the course. In addition, the student has to enter into dialogue with the teacher by asking questions, reviewing course materials, and seeking feedback. Online courses that use a variety of communication tools to facilitate internal and external dialogue decrease feelings of distance for the learner.

**Structure**

A structure of a course is determined by the philosophy and objectives of the teacher, the framework provided by the educational institution, and the type of media used to facilitate
communication and course materials (Moore, 1997; Rovai, 2002). A course with highly structured assignment instructions and a lack of opportunities for student choice increases the transactional distance for the online learner. An online course that provides detailed instructions and encourages students to personalize topics to the course objectives, while engaging students with a variety of dialogue tools, increases the learner’s autonomy and connection to the learning materials (Gokool-Ramdoo, 2008).

**Autonomy**

Learner autonomy is established by providing an online course that supports a variety of student behaviors and communication tools. A course that provides flexibility within the learning structure, includes detailed instructions, and offers multiple ways for dialogue creates a learning environment that speaks directly to the needs of all learners, fostering learner autonomy. The quick-to-learn student is able to navigate the course freely, and the more reflective student can spend time engaging with the course, which supports a student-centered learning approach and decreases the transactional distance for the online student.

**Summary**

The TDT framework has a strong focus on understanding how the online space is experienced in order to use design principles to create active learning environments that increase learning. The TDT places a strong emphasis on the design of the course as an important component that enhances communication between peers and the development of learners’ autonomy. Effective instructional design has the capacity to facilitate communication and the development of learning communities (Lee & Huang, 2018).
The TDT theory is rooted in a constructivist paradigm. There are scholars, however, who maintain that the theory lacks structure and a formulated approach to studying the online learning environment.

**Critics**

Giossos et al. (2009) highlighted the lack of a threshold when evaluating TDT to determine if enough structure, autonomy, and dialogue have taken place in an online environment to decrease the psychological space between the learner and teacher. In response, Moore (1997) affirmed that the theory is a tool for analysis, question development, and empirical testing. Giossos et al. (2009) also argued that TDT is perceived differently based on various cultures and the educational context of the learner, which create a more abstract understanding of how one might perceive the TDT in online learning.

Researchers and practitioners have called for the constructs of TDT to have more structured variables when understanding the online learning environment. Moore (1997) created TDT using the constructivist theory paradigm. The constructivism lens is rooted in using the learner’s story to create knowledge along with others who have experienced the environment being studied. Through the constructivist paradigm, the role of the researcher is to understand that knowledge is created from the relationship the participants and researcher might have with a given topic. The main goal of a researcher using the constructivist paradigm is to build theories, concepts, and abstract findings to construct a truth (Merriam, 1991). The online learning environment is rapidly changing, and the ability of the TDT framework to provide flexibility for researchers ensures the body of knowledge continues to grow and mirror the learning environment and meets the needs of various learners enrolled in online education.
**Rationale**

The rationale for using TDT is that a VLE has the capacity to decrease the psychological space for the online learner. The technology influencing the 21st-century learning environment has shifted the focus from looking at the impact of the structure of a class to understanding the transactional behaviors that enhance online student performance. An online course designed to enhance the relationship a student has with the components of transactional distance enhances feelings of learner autonomy, which decreases the psychological space and distance for the student, leading to higher student performance and satisfaction (Bollinger & Halupa, 2018; Rovai, 2002). Online learning capabilities continue to change; however, the distance of the student to the teacher, peers, and university setting has not been mitigated (Bollinger & Halupa, 2018). When the transactional distance is decreased, learners feel more confident about their learning and have increased satisfaction, resulting in an increase in self-directed learning (SDL) behaviors attributed to academic success for online learners (Cho et al., 2017; Inan et al., 2017; Rovai, 2002).

TDT suggests that if the learning environment is designed to enhance the presence of communication and connection between the learner, teacher, and the content of the course, cognitive understanding of learning outcomes should increase. The 3D environment does enhance student motivation, with entertainment increasing information retention (Davis et al., 2018; Topu et al., 2018). Topu et al. studied the relationship between different variables related to information retention in 3D environments in a quantitative study. Flow, presence, and engagement scales were established to measure the participants’ relationship between each level of information. In the study, Topu et al. defined flow as “the state in which people are so intensely involved in an activity that nothing else seems to matter; the experience itself is so
enjoyable that people will do it even at great cost, for the sheer sake of doing it” (p. 1623). The variables unite to the student’s connection to course content, which falls within the TDT framework. A common theme found in studies that evaluated the impact of TDT for online learners was the importance of being able to communicate with students and the teacher’s being able to move around the learning environment easily (Kassandrinou et al., 2014; Topu et al., 2018).

The TDT focuses on how the online learning environment is designed to foster communication and provide learner autonomy, which leads to enhanced knowledge of the provided content. As a leading element in the online environment, VR will need to play a role in understanding how structure, dialogue, and autonomy affect the online learning space as it mirrors more of the campus learning environment.

**Application**

The TDT framework utilizes the structure of the course to understand how students are able to communicate with each other and the instructor, while also making sense of the design of the course and how user experience is enhanced. Through the proper design and facilitation of dialogue within the course, learner autonomy increases, which decreases psychological space for the online learner (Moore, 1997). When the psychological space is mitigated for the learner, the learning environment takes on attributes that are similar to how a campus student feels when taking face-to-face courses. Current research on VR has already produced positive findings on the impact of VLEs related to student performance and feelings of satisfaction in courses based on the structure and the ability to learn in a risk-free space. The TDT has provided the framework to explore how the environment is understood from the student perspective. Using the
student lens to understand how VR is impacting the learner, educators will have the research to ensure that VLEs are being created to enhance student success in online learning.

**Conclusion**

Online learning has struggled to meet the same academic threshold as the campus environment when it comes to attrition and persistence, leaving a gap between campus and online students in their ability to graduate. To transition to this interactive form of technology, educators are being asked to adopt pedagogy that uses technology to enhance online engagement, motivation, and cognitive understanding.

Since the development of technology, VR is the first tool that has the ability to make online students feel as if they are in the learning environment with their peers, no matter their physical address. The latest research on VR provides positive findings related to bridging the distance gap that online students feel when compared to campus students. Learning behaviors such as motivation, communication, creativity, development of empathy, and cognitive enhancements have been connected to positive research with VR in education. However, the adoption of VR in education will need to be influenced by the educators since they oversee the course curriculum.
Chapter 2: Literature Review

The purpose of this research was to explore the connection between virtual reality (VR) and transactional distance on student learning in distance education through a qualitative interpretative phenomenological analysis (IPA) study. VR is rapidly changing how distance education students experience online learning. The 21st-century online student is prepared for an immersive learning environment from the development of modern-day technology. VR has the ability to provide a game-based atmosphere to stimulate engagement and motivation between the learner and the curriculum. Students no longer have to contend with the physical distance that separates them from the face-to-face learning environment. Learners are able to engage with classmates in authentic environments to build relationships and develop a community of peers to decrease feelings of isolation and develop skills and behaviors related to positive learning behaviors. Educators are able to design engaging environments that simulate real-world feelings to enhance the presence of the curriculum using instructional design mythology and support from leadership.

This literature review focuses on the areas that have played an essential role in the development of VR in distance education. The main four sections of this review address (1) the evolution of technology in education, (2) online learning, (3) VR and virtual learning environments (VLEs), and (4) instructional design methods and challenges for online learning and VR implementation. The historical context of technology in education highlights the continuous development of teaching with digital tools. Understanding teacher and student behaviors in the online learning environment plays an important role in adapting and implementing VR in online education. This chapter reviews recent studies that have used VR to enhance learning, highlighting student behaviors and design practices that need consideration.
when creating curricula for VR. Finally, instructional design methods will be explored to understand how design impacts the student learning experience.

The Evolution of Technology in Education

The chalkboard, SMART Board, and learning management system (LMS) are examples of educational tools used by academic institutions to enhance learning and create an engaging learning environment for students. The first tool known to communicate information to a large number of students was the chalkboard. The chalkboard, which later became the white board, was developed in 1801 when James Pillans hung a piece of slate on the classroom wall in Edinburgh, Scotland (Muttappallymyalil et al., 2016). In the late 2000s, the SMART Board (developed by SMART Technologies) became a teacher favorite and quickly began to replace the chalkboard. The SMART Board allowed the teacher to project images from a computer to a blank wall that allowed students to interact with the content. Since the early 1970s, computer labs have been a mainstream component of a learning facility. The computer lab supported the lab rotation blended-learning model that created an online learning space with the teacher still able to facilitate the learning, and it allowed students to engage with self-paced learning and still receive support from an educator (Krause, 2000; Muttappallymyalil et al., 2016).

Technology in education has evolved significantly from the chalk board. Throughout the 1970s and 1980s, President Kennedy and President Nixon supported the use of government money from the National Defense Education Act and Vocational Education Act to increase the use of technology in education, allowing educators to purchase computers for their classrooms. The classroom computer lab allowed teachers and students to stay in one central location when working with technology. During the 1990s and 2000s, a surge of technology funding in education occurred, allowing schools to install Web servers and gain access to the Internet
(Webster, 2016). While educators were moving away from the chalkboard to the interactive SMART Board, the U.S. Department of Defense established the ARPANET project in 1966, which led to the development of the World Wide Web and the ability to host documents and deliver educational courses through an LMS. The LMS allowed the educator to extend learning outside of the normal class hours and put the student in charge of when and where learning took place. Through the development technology and the LMS capabilities, online learning and distance education evolved at a faster pace than higher education was prepared to accept (Gal & Lewis, 2018; Goralski & Falk, 2017). Now, mobile devices, tablets, and laptops are part of the 21st-century classroom.

The development of the LMS was connected to the University of Illinois in the late 1960s and early 1970s (Goralski & Falk, 2017). The LMS was called Programmed Logic for Automated Teaching Operations (PLATO). After PLATO, another fabricated system called the Electronic University Network was established in 1983 to provide quicker communication and a more user-friendly learning experience. The ability to use an LMS to connect with students has transformed pedagogical methods and removed physical barriers that held students back from attending a school at a physical location (Manning-Ouellette & Black, 2017; Dumford & Miller, 2018). The development of an LMS that can support the use of VR, augmented reality (AR), and mixed reality (XR) for online learning requires proper technological support for an interactive 3D environment (Merchant et al., 2014).

**Online Learning**

From fall 2015 to fall 2016, online enrollment in higher education grew by 5.6%, which marked the 14th straight year of growth in distance education (Seaman et al., 2018). The enhancement of technology aided in the growth of online learning. The quick online growth
propelled academic institutions to develop online courses at a rapid pace, with little consideration given to online pedagogy (Lee et al., 2020). As a result, online courses did not create an active learning environment that supported the needs of various learners (Kilbanov et al., 2018). In addition to the lack of design and innovation for the online environment, educators did not receive training on how to teach online, which resulted in the development of online curricula that often lacked pedagogy to fit the online learner (Davis et al., 2018).

Over the years, educators and administrators continued to explore how the various technological innovations can be used to enhance the online space, how to teach online, and how to design an online learning environment that allows the online student to succeed. The literature focused on distance education will highlight how technology has impacted the online teaching environment, online student behaviors, and the design and user experience principles that enhance the online learning experience.

Teaching in the Online Environment

As technology was leveraged in online learning, teachers were expected to understand how to properly implement the technology for online learning with little training. Digital technology is versatile and can be used in multiple ways; however, technology can be unstable and confusing if the tool is not easy to understand and implement (Koehler et al., 2017). As a result, educators faced new challenges with digital tools that created a larger gap between their willingness to use technology to enhance online education and maintaining a learning environment with sound pedagogy.

“Technology, Pedagogy, and Content Knowledge (TPACK): A Framework for Teacher Knowledge” (Mishra & Koehler, 2006) explained how the teacher’s knowledge regarding technology provided the ability to incorporate effective teaching with technology. The TPACK
framework is the interaction of a teacher’s knowledge in content, pedagogy, and technology. TPACK suggests that teachers’ level of understanding about technology affects the way that curricula are designed and implemented within technology, which transfers over to the online environment, development of course content, and the use of digital tools. Pedagogical content knowledge (PCK) is the transformation of content for teaching (Shulman, 1986). Technology content (TK) is the certain way of thinking about and working with technology; however, TK is always in flux for an individual and is difficult to define. Pedagogical knowledge (PK) is the instructor’s knowledge about processes and practices for teaching. Technological pedagogical knowledge (TPK) is understanding the pedagogical constraints and affordances within technological tools and their connection to teaching and learning. The collective of each of the categories equates to the TPACK framework. The TPACK framework acknowledges the deep understanding that emerges within a teacher’s interaction with pedagogy, content, and technology knowledge. Once educational leaders identify where faculty members are within the TPACK framework, the proper type of support training can be designed to enhance any areas in the framework where faculty members are not proficient (Kibaru, 2018). Educators face new challenges with digital tools, creating a larger gap between their willingness to use technology to enhance online learning and their need to maintain a learning environment that connects with the 21st-century learner (Sarapin & Morris, 2015).

Faculty members have reported that how they personally perceive and use technology outside of the classroom is a determining factor for the type of technology they implement in a learning environment (Shelton, 2018). While the use of technology can create more time for teaching, faculty members have anxiety over losing control of course materials and understanding how to teach with student-centered strategies (Kibaru, 2018; Webster, 2016).
Conversely, faculty members have reported a cost savings by introducing technology tools into the classroom—for example, using the LMS to host documents instead of needing to print papers or using video conferencing instead of travelling to the campus. Faculty members have recommended that an environment should be created that encourages the use of technology and that administrators should not mandate practices requiring implementation of the tools. Faculty members who have implemented technology in their curricula commend the role that department managers, colleagues, and students have played in their adaptation to technology (Shelton, 2018).

An ecological study explored how educators experienced an educational technology trade show. Eight educators from different schools in Sweden attended a large educational technology and transformational trade show and reported that digital tools being sold to educators often came from those who were not educators and had not utilized the online learning space (Player-Koro et al., 2018). As a result, technology tools were being developed that did not meet the needs of the educators. The educators who participated in the study recommended that educators, developers and designers of digital tools for education, and policy makers who are increasing technology budgets work together to enhance the way that digital technology is being bought and designed for education. Ultimately, how faculty members experience technology in their own environment and how the use of digital tools is communicated to them from leadership impact how the tools are implemented in the curriculum.

Online learning requires a different type of learning environment to support student learning and course engagement (Ferguson, 2020; Goralski & Falk, 2017; Robinson et al., 2017). Gregori et al. (2018) analyzed the research literature with regard to students’ online dropout habits and retention strategies and identified three guidelines to decrease the dropout rate in
online education: (1) making initial contact with students on the first day, (2) providing tutoring and course communication in a virtual classroom such as online community board, messages, or course announcements, and (3) providing short objective learning assessments through writing, oral presentations, and tests. The more the educator worked to connect and remain “present” with the online learner, the greater the chance that the student remained motivated throughout the duration of the course. The findings from Gregori et al. (2018) support a similar study Blakey and Major (2019) completed on student engagement.

**Student Behavior in the Online Environment**

Online learning has continued to gain momentum every year; however, the dropout rates for students in online courses have remained higher when compared to those students enrolled in face-to-face courses (Christensen & Spackman, 2017; Larmuseau et al., 2019; Phirangee, 2016). Online student attrition was found to be 3% to 5% higher than campus-based student attrition (Shaw et al., 2016). Online retention challenges are attributed to feelings of isolation, lack of interaction between peers and teachers, distractions, and issues with personal attention behaviors, ultimately leading students to feel disconnected to the learning process and university community (Ferguson, 2020; Gay & Betts, 2020; Phirangee, 2016). The sense of community among learners is established through the development of trust, connection, and similarity with other students over time (Hoey, 2017; Lee & Huang, 2018; Ouyang & Scharber, 2017). The online environment struggles to foster a sense of community because students are completing coursework at times that are convenient to their schedules and not working in a community environment similar to campus learning (Goralski & Falk, 2017; Phirangee, 2016; Soffer & Cohen, 2018).
The discussion board is heavily utilized in online learning to foster community and engage students in the course content through analysis and reflection (Yoo & Yin, 2020). However, learner-to-learner interactions can negatively impact a sense of community among the students (Phirangee, 2016). The following interactions negatively impacted online students’ experiences: The “keener,” lack of meaningful dialogue, lack of attribution, tangents, editing notes, and cultural exclusion. The “keener” was defined as the student who dominates the discussion board by responding too frequently to student posts. The discussion post where students only posted “good job” or when students’ posts were ignored by peers was associated with a “lack of meaningful dialogue.” Students saw when other students plagiarized or showed “lack of attribution” from previous discussion posts and did not give credit to the original contributor. “Tangents” related to students who were not open to a discussion and provided long posts centered only on their thoughts. When students made “editing notes” after the deadline, it bothered the students who tried to create a robust and timely post. “Cultural exclusion” revolved around students’ not being able to see peers who mirrored the same likes and dislikes. Learners who engage in the discussion board have reported difficulty with understanding and managing the content shared by their peers (Yoo & Jin, 2020).

One of the attractions of online learning is the flexibility that allows learners to gather new knowledge and skills at their own pace (Goralski & Falk, 2017; Phirangee, 2016). To understand how 16 pharmacy students were impacted by taking distance education courses, the data from an exploratory study were examined (Kilbanov et al., 2018). The two groups had the same course content; the only difference was that the campus students were able to attend live lectures, while the online students attended lectures through an interactive video conference. In a comparison of the experiences of both groups, the online students had significantly lower course
grades than did the students who took classes on the main campus. However, both groups of
students felt they had increased their knowledge of course content. When comparing the
students’ perceptions between online and campus, the campus students were more confident
about the knowledge they had gained. Both of the groups reported positive feelings related to
their learning environment. The lack of teacher training for the faculty member who taught the
online course might have played a role in the course content not transferring over to the online
environment, resulting in the lower course grades for the online students.

Whereas feelings of isolation and lack of community may have played a role in why
online students did not persist as did the campus students, online students were equally satisfied
with their online courses. The only difference between the academic performance of campus and
online students was that online students did not perform as well (Kilbanov et al., 2018). The
online learning environment differed from the campus environment by allowing students to learn
from their peers by sharing resources and thoughts via discussion forums, have access to more
ideas from peers, and have time to reflect on course material before needing to respond. The
development of an online community might increase course satisfaction; however, research has
displayed conflicting information on the connection to enhanced learning outcomes.

There are many facets to helping the online learner succeed, from due date flexibility, to
the students’ experience with online learning, to the instructor’s ability to facilitate a sense of
community among learners. Among the attractions of online learning are the opportunity for
students to complete schoolwork at their own pace, the accessibility to learn on-demand, and the
flexibility to schedule learning around the demands of work or parenting (Ferguson, 2020; Shaw
et al., 2016). The flexibility of the online environment can be fruitful; however, students are
required to have high levels of self-regulatory learning (SRL) behaviors to succeed online. The
four main behaviors of SRL are planning, time management, help-seeking, and self-evaluation (Inan et al., 2017; Webster, 2016). Out of the four components, planning was closely correlated with student SRL and online success and satisfaction. Time management, help-seeking, and self-evaluation did not have impact on self-regulation skills connected to success and satisfaction. However, other research has highlighted a direct connection between SRL behaviors of time management, help-seeking, and self-evaluation to play an important role in the success of an online student. Cho et al. (2017) found that the more planning, structure, and communication provided to students in an online course, the higher the possibility that they will be successful and feel connected to a learning community.

Similar to educators, students’ prior knowledge and comfort with Web 2.0 tools were found to be connected to students’ self-directed learning (SDL) behaviors (Sumuer, 2018). SDL was connected to improving the quality of student learning and to preparing students for life after college, which is a fundamental goal of higher education (Shaw et al., 2016). For educators to create an SDL environment, five components were found to be important to the creation of the course: (1) diagnosing learning goals, (2) creating learning goals, (3) developing and implementing learning strategies appropriate for the content, (4) identifying materials needed for learning, and (5) assessing learning outcomes (Sumuer, 2018). When an online course was properly designed, online students were comfortable navigating the learning platform and engaging with the course material (Manning-Ouellette & Black, 2017; Gregori et al., 2018).

Educational institutions strive to create a learning environment that allows all students to succeed. The universities provide funding and training to help educators learn how to teach online. Similar to the educators’ adoption of technology, students who adapted to technology tools had an increased perceived ease of use, which correlated to higher SDL behaviors.
Teachers have to know how to engage learners and work with them on developing healthy self-regulation behaviors, so they can succeed when learning through a computer (Sumuer, 2018). Once the educator creates the optimal learning environment, a focus needs to be placed on the design of the space to work in conjunction with the teaching methods.

**Online Design and the Connection to the User Experience**

Technology has changed the online learning landscape and accelerated the need for a universal design that ensures ease of use for the online learner (Dumford & Miller, 2018; Haynes, 2018). Online courses need to be designed to enhance the online student experience, while also decreasing the transactional distance felt by the learner. The three most effective, scalable teaching strategies to activate learning online and decrease transactional distance have been found to be cooperative learning, simulations and gaming, and interactive media (Davis et al., 2018; Roman & Racek, 2019). Cooperative learning included teaching strategies that allow learners to help and support classmates’ understanding of course materials, which was associated with improved persistence, completion rates, and student engagement (Davis et al., 2018). Simulation and gaming in curricula were found to be related to developing programs of study that allow students to compete against themselves or each other to complete assignments (Davis et al., 2018; Merchant et al., 2014). The incorporation of simulation and gaming in the curriculum enhanced learner achievement and the development of SRL traits (Huang & Liaw, 2018; Merchant et al., 2014). SRL was defined as learning that occurred by students who have a high intrinsic goal orientation, confidence in learning, control of learning, value-taking, and effort regulation (Inan et al., 2017). The use of interactive media in an online course supported the use of videos, tests using interactive media, and teacher-developed lecture videos; these were found to be the most beneficial ways to increase student engagement in a course (Evans &
Gibbons, 2007; Patwardhan & Murthy, 2015; Topu et al., 2018). All three of the effective teaching strategies cultivated a community of learners, accessibility, activity, and hosting resources that were essential to online learners’ success (Aldosemani et al., 2016; Topu et al., 2018). To remove barriers for the online learner, the University of South Carolina, one of the recognized leaders in quality assurance for online learning, established a framework for instructors to create an optimal online learning environment for students (Haynes, 2018).

Providing step-by-step instructions, offering multiple formats of materials, ensuring documents are accessible, utilizing closed captioning, ensuring readable font and font size, bolding words to emphasize importance, using ongoing on-on-one communication, and helping facilitate the development of relationships were all important to creating an online learning environment that provided the basic structure to help online students succeed (Haynes, 2018; Manning-Ouellette & Black, 2017; Sumuer, 2018).

To properly prepare for the large number of students enrolling in a distance education program, educational institutions began to expand their information and technology budgets to create the infrastructure needed to support online learning. In addition to needing an enhanced infrastructure for online learners, administratively there needed to be support staff available who could help the distance education students troubleshoot technical issues that might arise for them as online learners (Kilbanov et al., 2018). In 2015, it was estimated that 13.2 billion dollars were spent in the United States on hardware and software in educational technology. The increase in spending can be attributed to profit-driven trade associations, government, and local policy makers. As a result, educators not only needed to learn new technology; they needed to understand how to work with leaders in education to help shape the type of technology that was adopted into courses. A relationship between administrators and educators will ensure that the
tools will enhance the learning environment and connect students to their course needs and classmates (Player-Koro et al., 2018).

Online courses that are well designed were found to have a decreased dropout rate compared to other online courses (Christensen & Spackman, 2017). To identify the points in the curriculum associated with student withdrawal rates, Christensen and Spackman’s quantitative study examined 50 courses and found five distinctive dropout behaviors that provided insight into the relationship between curriculum and dropout patterns: (1) students lost momentum to complete the course due to difficult assignments, (2) difficult assignments were placed too closely together in the curriculum, (3) there was no recovery time between difficult assignments, (4) at the start of the course, when students saw the curriculum, they deduced that the curriculum would be difficult, and (5) there were late dropouts when students knew they would not be able to pass the class due to the difficult content. Other studies found that instructional materials and content that were not properly adapted for online learning were reasons students dropped out of online courses (Phirangee, 2016; Lee et al., 2020).

One of the main elements of online learning is the discussion board. The discussion board allows students to work together to create and share knowledge, which enhances the feelings of belonging to a community (Gay and Betts, 2020). Instructors’ discussion design and facilitation of the online learning community play a critical role in online learning (Ouyang & Scharber, 2017). Recent research focused on the instructors’ involvement in the online community, with little research directed towards the design and facilitation of the learning space. Three critical factors to developing an online community were related to learners’ engagement, participation, and interaction. Discussion board provided an interactive, cohesive, and distributed network
among learners, which was found to be a critical factor in developing an online community (Hoey, 2017; Ouyang & Scharber, 2017).

Three stages of designing an online discussion board that fosters learning and a sense of community among learners were identified by Ouyang and Scharber (2017). The first stage of design fostered communication and interaction and provided an opportunity for the learner to observe how interaction was taking place in the discussion board. The first stage was when the instructor needed to be active on the discussion board to facilitate the conversation and model the expected behavior. In the second stage, learners took on an active role and began to collaborate and commit to the community through participation. This stage was when the instructor started to move away from the discussion board and allowed the students to take on more of the facilitation around interaction. In the third stage, learners participated in projects together, and the teachers were not active on the discussion board. This action provided complete autonomy between the students and the course content. When teachers started the semester with a heavy presence on the discussion board and slowly shifted to that of a facilitator, discussion groups began to form and shape into a community of learning. Additionally, the design of the groups influenced the development of the community. Putting students in groups together provided more interaction between peers, as opposed to having all students in the course be in one large discussion group; grouping the students by interest allowed students to form a stronger community with their peers. The online learning environment took on a different shape with each type of learner; however, there were basic user experience components within online learning, such as discussion board facilitation, that could enhance online learning.
Conclusion

Providing online education to our 21st-century learners has been essential to the growth of higher education. The dynamics in the online environment were not consistent in ways that we see in the campus classroom. The online students tend to be older, have more responsibility, and often report less experience with online learning environments, creating a discrepancy between the traditional elements that are familiar to many educators. Many of the teachers attended teacher training programs that did not involve using technology to enhance pedagogy, and educators had to rely on self-teaching or in-service programs to learn what tools to adopt into the learning environment. With the momentum behind technology and the impact it will have on education, leaders in academic institutions work on providing training to educators to help increase the perceived ease of use, resulting in educators adding more technology to their online environment.

The demographics of online students vary, depending on fluctuating variables, creating a larger knowledge gap in how the educator can create an engaging learning environment that will enhance understanding of course material. Online students often struggle with persisting in courses due to a disconnection felt in the student–teacher, student–student, and student–content relationships. Educators have a responsibility to teach and take on the role of course designer to ensure the way that students engage in the classroom helps them feel they belong to the learning environment. As a result of the infiltration of technology tools in education, educators are expected to step out of their traditional teaching roles to create learning environments that meet the needs of the 21st-century learner.

Data on the rate by which online students drop out of online courses can change based on what a school considers the point at which a student stops engaging with the course material.
However, what remains consistent is the way that educators select tools for online learning, the facilitation of communication and engagement, the discussion board dynamics, and the design of the online environment. As advanced technology, such as VR, starts to move into education, faculty members will need training on how to best implement the tools in the learning environment to help bridge the gap between campus and online learners.

**Virtual Reality and Virtual Learning Environments**

The infiltration of technology within education has been on the rise since the information era of the 1990s; however, it was not until the millennial generation when students’ ability to connect, seek information, and develop advanced technology skills through a mobile device pushed educators to blend technology with pedagogy (Lee et al., 2016). While VR has been tapped as the next futuristic technology, little research has been conducted on how the tool can enhance learning (Huang & Liaw, 2018; Ludlow, 2015). In order to create graduates who can easily move into the workforce, industries have been collaborating with education to create authentic learning experiences that mirror professional environments. The potential of VLEs developed through VR creates a new hands-on approach to learning and engaging with course material that resonates with the 21st-century learner (Radianti et al., 2020). The literature on VR and VLEs identifies how VR can be utilized in educational settings, the impact on student motivation and creativity, and the importance of the design and user experience.

**Learning in Virtual Environments**

VLEs simulate real-world environments that transport learners to immersive environments, increasing student motivation for learning and increasing student knowledge (Akbulut et al., 2018; Chang et al., 2016; Huang & Liaw, 2018). Compared to other learning environments, one advantage of VR is the vast number of learning opportunities available
through virtual space (Chang et al., 2016; Patterson & Han, 2019; Shin, 2017). VR can create environments for learners that mirror qualities familiar to them through games, immersion, graphics, and interactivity (Huang & Liaw, 2018; Yang et al., 2018; Yeh et al., 2020).

A detailed example of research on the use of VR in higher education was a case study with 25 college freshmen to understand the students’ opinions using VR glasses in a history course (Yildirim et al., 2018). Out of the 25 students, only 24% had used VR glasses, and 76% had not engaged with VR glasses or VR in an educational setting. At the end of the course, the researchers reported that 100% of the students enjoyed using the VR glasses for the history course. Two of the participants highlighted the need for educators and designers to make the course content immersive and conducive to a VLE. Additionally, concerns were shared related to students who were not familiar with VR and might not be able to navigate the space easily, supporting a study that called for design structure to be considered in VLE development (Madden et al., 2020). The students reported feelings of being in a real-world environment and wanted to explore destinations that were unique to them and did not relate to course material. The students indicated that the VLE content had a stronger learning impact compared to environments or learning scenarios that would have been presented in the class. The students discussed the type of VLE they would like to experience, such as trips to historical events and locations.

Modernizing online learning to support the use of VR and VLEs enhances the value of the learning and brings the online learner closer to the teacher, classmates, and the course content (Huang & Liaw, 2018; Yang et al., 2018; Zizza et al., 2017). One of the important pieces of the VR learning puzzle is understanding the cognitive impact the tool has when used in an educational setting (Madden et al., 2020).
The VR space creates an opportunity for educators to enhance knowledge acquisition through the interaction afforded in the VLE (Yang et al., 2018). Based on the change in technology, the attributes of VR have moved the tool to the top of the list as the next big form of technology that can be used in education to increase learning (Johnson, 2018; Madden et al., 2020). Educators are looking for ways to create more engaging learning environments and are turning to VR as a medium for content delivery (Stelis et al., 2015). Eighty-three percent of the educators in one study were found to believe in VR and the power it has to transform the classroom (Lee et al., 2016). Lee et al. (2016) found that, when VR was used for content delivery, there was a significant difference in user interaction, resulting in a more engaging environment, but lacking in a cognitive increase due to the type of content presented in the VLE.

In contrast to the study by Lee et al. (2016), Yoon et al. (2017) focused on the direct connection with using AR to help students understand a complex science topic. Using an AR platform to host 58 middle school students, the researchers conducted a pre and post survey and found that AR had a positive effect on helping students understand the complex science topic. In addition, the students reported that they understood the material better due to their ability to experience the concept instead of only understanding it through reading. The findings of that study demonstrated that, through simplified AR, students were able to better connect with course material.

As technology continues to grow, educators are challenged with providing learning media that facilitate a student-centered learning approach (Alfalah, 2018). VR is considered one of the novel mediums based on the ability for the VLE to create a hands-on, student-centered learning approach, which has yet to be fostered in online learning (McFaul & FitzGerald, 2019). To understand how to improve the learning experience and engage with modern-day students, a
study was conducted using VR and artificial intelligence (AI) in a VLE (Ijaz et al., 2016). Three
groups of students were studied: one group used textbooks only, a second group watched a
documentary, and the third group was immersed in a virtual environment. The students in the
third (i.e., VLE) group learned by observing avatars, chatting with peers and virtual agents, and
reading short text information. Those students had positive feedback about their learning
experiences, and their comprehension improved with a 20% average higher performance
compared to the other two groups. The textbooks-only group outperformed the documentary
group, supporting the importance of creating an active-learning environment for comprehension.
Reading is an active form of learning, and the students could reread if needed and see images
that went with the reading. The finding supported the importance of VLE where students have
the ability to perform tasks repeatedly, whereas the video group could not go back and watch the
video again. Additionally, the study found that the VR group had increased motivation and
engagement in the VLE compared to the other groups. Intentional design of the VLE has been
found in other studies to be essential to enhancing the learner’s connection to the material (Lee et
al., 2016; Yoon et al., 2017).

**Using Virtual Reality to Engage the Online Learner**

The influence of immersive technology in learning environments can transform
traditional learning approaches that have failed to motivate students to learn (Ijaz et al., 2016). A
VR-based learning environment allows users to play, experience, and enhance cognitive learning
skills utilizing real-world situations to interact with objects and understand feelings similar to the
natural world (Lin et al., 2017). Utilizing a low-cost VR system to enhance the classroom, a
study was conducted to understand the connection between VLE and student motivation
(Webster, 2016). One of two groups received a lecture delivered via a multimedia presentation in
a typical classroom, while the second group received instructions for assignment in VR. The group using VR had to move shapes and had an avatar to answer questions. Both of the groups listened to media, watched videos, and played a shooting game. Results revealed that, while both forms of learning were positive, the VR-based group had more interaction between peers and a higher rate of completion of assignment, compared to the group that did not utilize the VLE. Despite the positive response VR has received in education, others have raised numerous questions about how students feel when they use the devices and how that impacts levels of engagement and motivation (Alfalah, 2018; Shin, 2017).

VR provides a unique learning space, increasing the users’ desire to engage with material and enhance student learning (Ludlow, 2015). VR expands the computer from purely visual interaction course satisfaction and knowledge to a diverse immersion interaction among users (Lin et al., 2017). Users experience five affordances when interacting in a VLE: presence, immersion, usability, empathy, and embodiment; these affect how immersion and presence effect student involvement in the VR (Yoon et al., 2017). Through the five affordances, users feel connected, immersed, comfortable, empathetic, and engaged mentally and physically in the VLE. When users are immersed in the VLE, the situations they are working in start to feel real, which continues to increase the feelings related to embodiment and empathy (Shin, 2017). When a student is able to engage in an immersive environment like the one VR affords, the student can create a new behavior or perform a task repeatedly without punishment, thus increasing motivation, (Yildirim et al., 2018; Ludlow, 2015; Shin, 2017).

VR-based environments give users autonomy to create, delete, and add objects that are not real, generating space for students to increase originality and understanding of abstract concepts (Yang et al., 2018; Kim & Ke, 2016). VR combines project-based learning with
constructivism to provide an immersed learning environment, enhancing understanding and increased self-determined learning that are important to the real world (Huang & Liaw, 2018; Lee et al., 2016). The data from a multiple case study with five preservice teachers, two graduate students, and three undergraduate students were examined to understand the experience of the participants and how they interacted with content and learning activities (Kim & Ke, 2016). Participants in the VLE were more active during the task, reported increased interaction with their peers through the chat feature, and experienced enhanced VR-based environments, allowing users to personalize their learning, a factor linked to increased engagement (Cohen et al., 2018; Ijaz et al., 2016; Soffer & Cohen, 2018; Yildirum et al., 2018).

**Virtual Reality Design and the Impact on the Learner**

The structure of the space that is created plays an important role in fostering the interaction between peers, teachers, and the course content that elevates cognition, motivation, and feelings of increased social presence (Larmuseau et al., 2019; Yoon et al., 2017). When analyzing the role that avatars have on the Real and Virtual Engagement in Realistic Immersive Environments platform (REVERIE), Economou et al. (2017) discovered common themes to provide clarity around the design for realistic human representation in the virtual environment (VE). The VE should mirror real settings: the ability to personalize the avatar increases feelings of the connection between the VE and real-world environments, the need for platforms to support private conversations, and the ability to take control of an avatar to assist with an activity when needed. The facilitator avatar can use communication, personalization, and the environment to track students’ behaviors and provide guidance on how to complete activities influencing learning outcomes and fostering communication. The five layers that should be in place to provide VR-based environments that enhance learning are perception layer, function
layer, algorithm layer, information, and physical layer (Chang et al., 2016). The perception layer provides the supplies that a student will need to interact in a VR-based environment, such as a headset, Internet connection, and computer or mobile device. The function layer is the design of the system and the physical layer that simulate a real-world environment and provide a structure for displaying images, transferring information (chat feature), and adding other essential components to the function of the VR space. Once the supplies have been provided and the system has been created, the algorithm layer focuses on the data-processing and integration of algorithms to operate the VR-based system. The information layer is where the instructor provides instructions, a description of expectations, and any other materials that are needed to provide a safe and productive learning environment. The classrooms, buildings, meeting rooms, tables, chairs, etc. comprise the physical layer.

Jensen (2017) set out to explore the development of VR-based designs to understand how to create collaborative VLEs. Using design-based research as the methodology, participants were selected from different educational programs and institutions to represent various professions to simulate roles and processes in the related environment. The results of the study shows the need for design principles that facilitate and address navigation, relevant activities, graphic effects, interface, and communication to foster a physical experience that provides students with a greater understanding of complex content issues and encourages creative inquiry. While Chang et al. (2016) focused on the design layers to create a functional VLE, Jensen (2017) utilized four gaming principles—quest, level, dungeon, and wipe—that highlighted the design elements that foster emotional tension and create reflection and experiences for the users. Ultimately, the four principles provide a defined task that can trigger a reward, a way to group players’ overall effectiveness at completing the task or activity, a location that shows the activities or task are
completed, and the ability of the facilitator to control the learning space and override users if they are off task, fail to complete lessons, or need insight during challenging content. The learning potential of the participants is strengthened when the system can support the avatars’ roles with specific tools, action, and options for learning.

Through an analysis of 29 studies in games and 27 studies in the category of virtual-worlds, Merchant et al. (2014) found that simulations, games, and virtual worlds were effective in improving learning outcomes. Merchant et al. further built on Chang et al.’s (2016) and Jensen’s (2017) focus on the layers within VLE and the types of outcomes that an educator is trying to achieve. Students who learned in VLEs that provided an opportunity to practice a concept, compared to students who learned from other instructional methods, were found to be more effective. Merchant et al. (2014) separated their findings based on a declarative task and procedural task in relation to how they enhanced learning outcomes. Overall, a declarative task enhanced learning outcomes more than a procedural task, encouraging the development of VLEs that are engaging and simulate a game-based environment (Makransky & Lilleholt, 2018; Merchant et al., 2014). However, educators often predetermine outcomes, resulting in the development of contrived VLEs that are not authentic to learning and rely on the technology tool to create an engaging environment (Lee et al., 2016). Designing a VLE will require the educator to build curriculum that is hands-on, to ensure the students receive the educational benefits of learning in VR (Sural, 2018).

To investigate the design elements of a virtual environment, a study using 12 student teams, involving 82 students, examined a virtual trade fair allowing students to practice a presentation to a panel in a VLE (Lee et al., 2016). Leading up to the event, tutorial sessions were held to explain the objectives and purpose of the activity and provide instructions on what
needed to be included in the presentation. Four VR rooms were created where the students were able to pitch ideas. Participants and judges walked in and out of rooms, and the students continued to present the information to the new room of guests. The judges and students reported concerns related to the noise level in each VR room, which created distractions, and said more time should have been given for the people who had never been inside that VLE before. The judges and students felt the VLE pitch was more professional and forward-thinking than years in the past. Participants did recommend that avatars should be designed to differentiate students, teachers, and another representative in a VR-based environment. Kim and Ke (2016) found that participants in a VLE need structure, communication, and personalization to feel comfortable moving around in the new space. Further research needs to be conducted to evaluate the importance of using design and learning frameworks to develop adaptive spaces and to understand how educators want learners to connect with the space (Huang & Liaw, 2018; Kim & Ke, 2016).

Conclusion

VR-based environments are infiltrating educational settings rapidly to create an engaging and active learning space. Recent research highlighted the connection between VLEs and increased understanding of course outcomes. Data and research have supported the importance of providing proper instructions, design, and facilitation in the environment depending on the learners’ and educators’ levels of understanding and experience in VR. Before a student is placed in a VLE, educators need to understand the learners’ perceived ease of use and understand the needs that the learners will have once they are placed in the virtual world.

Depending on the learning outcomes, educators need to provide clear and detailed instructions in the space to foster feelings of motivation and engagement. Educators are quick to
use a technology tool to foster authentic learning environments; however, the spaces rarely reflect a real-world environment. In contrast to a traditional classroom, VLEs have no walls and can provide an open area for learners and educators to engage with course content, practice their skills, use game-based strategy to enhance declarative task understanding, and increase feelings of empathy among the users. To stimulate a powerful learning environment, the educator needs to be mindful about the user experience in the space to optimize the learning outcomes and increase motivation.

Perceived usefulness, ease of use, and learning motivation, coupled with proper design, can influence a learner’s intention to use a VR learning system (McFaul & FitzGerald, 2019). Evaluating proper design strategies is essential to the learning that takes place in the VLE. Tying together the student’s level of experience in VLEs and the educator’s intended learning outcomes, a VLE space should be designed to meet the demands of both the student and teacher. If an environment is created that is too intense for the learner due to inexperience, lack of instructions, or issues with the VR device, the learner will become frustrated, resulting in lower levels of presence and a decrease in cognitive understanding of the material. Little research has been conducted on the best design strategies in VLEs, and researchers recommend that a focus be brought to this gap in knowledge.

Another area that has received little study is the cost of the tool and how educational infrastructures are being built to support the proper design of the VLE. While recent studies have highlighted how VR can enhance education, little research has been conducted on how the technology can be used to help create a more engaging learning environment for online students.
**Instructional Design Methods and Challenges for Online Learning and VR Implementation**

As LMSs continue to evolve to support the evolution of technology in education, instructional design frameworks should be used to ensure the online learner is receiving information in a way that enhances the learning environment (Guney, 2019; Lee et al., 2020). Advances in technology can be utilized to decrease the transactional distance for the online student (Bollinger & Halupa, 2018; Hoey, 2017; Lee & Huang, 2018); however, cognitive load, overstimulation, and lack of design can result in the learner feeling further away from the course content, teacher, and peers, while also decreasing the likelihood that information will be retained (Mayer, 2008; Ritz & Buss, 2016). Combining instructional design frameworks with VLE best practices allows online learners to experience learning in a way that is similar to a face-to-face environment and also models similar learning attributes that connect to increased student motivation, enhanced learning, and connection to a community (Despres-Bedward et al., 2018; Gregori et al., 2018; Mayer 2008). When the learner feels connected to the course content and engages with peers and the teacher provides the proper structure in the course, the student can navigate an environment autonomously and easily form connections to the learning material (Lee & Huang, 2018; O’Brien et al., 2017).

Instructional designers play a pivotal role in utilizing emerging technology to enhance the learning experience and ensure that educators understand how to properly implement the learning strategies in the immersive environment (Economou et al., 2017; Stoerger & Krieger, 2016). Research has identified an instructional design framework to use when building a VLE to increase learner learning, engagement, and feelings of autonomy.

**Virtual Learning Environment Design Challenges**
One of the main challenges of integrating emerging technology such as VR into the learning environment is when the educator lacks knowledge of how to integrate the tool with the learning material to create an immersive experience (Baldwin, 2019; Kibaru, 2018; Patterson & Han, 2019). To identify teacher challenges and develop recommendations on how to use VR to improve learning, a single-case research study was conducted by following the experience of one instructor (Patterson & Han, 2019). The educator worked with 28 elementary students to understand how to create historical empathy with students using VR. Patterson and Han worked closely with the instructor in implementing the VR and found that using VR for class lessons required a complete reconfiguration of the classroom to support the technology tool. For example, desks needed to be moved to create walking space as the students explored the VLE with the instructor. In addition, the Wi-Fi was not always strong enough for everyone to be in the VLE together, resulting in technical issues that caused students to fall behind. Consistent with the findings of Huang and Liaw (2018), Patterson and Han’s study revealed that lesson plans need to be specific to a VLE, teachers need to work together to share curriculum, and the use of the VR increased the perceived ease of use for teachers, which also increased the students’ knowledge about how to navigate the VR space. Online learners are responsible for mitigating their own challenges when using emerging technology, as reported in prior research, adding another level of complexity to the adoption of technology in online learning (Baldwin, 2019; Dumford & Miller, 2018; Haynes, 2018).

Implementation of VR in an online environment has additional challenges due to the number of variables that differ from one online student’s access to another and the challenges between the LMS and VR requirements (Alfalah, 2018; Chang et al., 2016). Administrators and educators need to be mindful of the different variables involved for online students and to create
a plan that ensures a successful implementation process for students and teachers. To understand the effective use of 3D VLEs and design judgments of students, a qualitative study was developed using Google Blocks (Roman & Racek, 2019). In a survey sent to the students after the 3D project was completed, the students reported logistical issues using the VR technology, the motion-sensing not always being charged, missing cables and cords, and headsets not fitting or comfortable. The level of activity required should determine if an interactive 3D virtual environment is needed. Developing course content that supports VLEs has been found to require additional attention by the educator or instructional designer, focused in areas that have not traditionally been part of the creation of curriculum (Baldwin, 2019; Ritz & Buss, 2016; Singleton et al., 2019).

The pedagogical criteria for VLEs that are essential to educational leaders are the abilities to prepare, apply, and assess learning needs before integrating VR in the curricula. The best uses of VR for educational purposes have been found to be for experiential learning theory, design learning theory, situated cognition, and constructivism (Johnston et al., 2017). Experiential learning is connected to Kolb’s (1984) framework regarding thinking, doing, and actively conceptualizing and experimenting with the experience. Design learning theory builds on already-existing knowledge (constructivism); however, this theory is most applicable for advanced users or students in high-level courses. Situated cognition is allowing the community to come together and practice activities and access context-specific knowledge. In addition to the assessment framework to determine if curriculum is prepared to be developed in a VLE, the LMS needs to have the proper technology to support the software and hardware requirements of VR.
The implementation of VR and 3D technology in online learning is still at the beginning stages of development. Engineering design and implementation of the technology need to be addressed in accordance with the systems available. There are multiple frameworks available to support the technology, such as the web-based multi-users system (WMU) described by Chang et al. (2016). In addition to the WMU, the multiscalar (MULTIS) architecture is a framework to integrate and support virtual learning environments in the LMS for e-learning activities (Morgado et al., 2017). Morgado et al. found that the need for a seamless transition between virtual learning worlds and teacher and student set-up was essential to the increase of VR implementation. Educators should have one system in the LMS that easily activates and maintains all user credentials or involve a technician at the school to help with the management of the virtual environment and learning assets. The MULTIS architecture highlights the ability to easily implement VR tools in the LMS and methods to integrate technical support within the framework. Systems like MULTIS and WMU provide the capabilities to enrich learning and connect distance education learners.

As a learning tool, VR has the attributes to enhance the online learning environment and model a face-to-face environment. VLEs are more interactive than other forms of learning and can enhance course materials in the LMS to connect and engage students with the curriculum (Ritz & Buss, 2016; Roman & Racek, 2019; Shin, 2017). VR increases presence by delivering spatial content that is hard to visualize in the real world. Instructional designers for VLE focus on four critical components that guide the development of VLE: virtual world/space, sensory feedback, interactivity with a focus on creating a sense of presence, and multiple perspectives for the user (Ritz & Buss, 2016; Topu et al., 2018). Creating objects that allow the student to change the perspective or manipulate the image is increasing the ability for learning immersion.
(Patwardhan & Murthy, 2015). In addition to presence, giving students control over the learning enhances the working memory of the student (autonomy), which increases engagement. To ensure successful delivery in a VLE, the instructions need to be concise and placed in the area that requires attention. Students new to a VLE require step-by-step directions on how to navigate and use various control features. Teachers should also be able to override the system to help students stay on track if needed. With a specific timeframe recommended and the four critical components of design, a VLE can increase cognitive understanding of topics for online students who are not able to attend a face-to-face lecture or lab. However, understanding how to combine the critical components to enhance learning requires intentional design structures (Baldwin, 2019; Mayer, 2008; Morgado et al., 2017).

Multimedia technology ignites the higher order thinking skills of learners (Guney, 2019; Zhang, 2018). Regarding multimedia, there are two components to understand from an instructional design side: hypermedia, and visualization and virtual communities. Hypermedia refers to a medium that represents the ability to complete activities with hyperlinks, graphics, audio, and video and to place text, which allows learners to gain knowledge on their own time and is directly connected to student autonomy. Visualization refers to using sensory organs, such as eyes, ears, and hands, to access information or a phenomenon. There is also cognitive visualization, which makes knowledge structures visible to the learner, such as atoms or molecules. Hypermedia is the ability to host the visualizations that connect with the knowledge visualization and the sensory transmitters that enhance cognitive understanding. Visualization is representing content through visual and verbal ways to address a task or exercise, which leads to an increase in content visibility and retention of information. Intentional instructional design with technology ensures the learner can understand the key learning aspects, main ideas, and
learning points, which are directly connected to increased understanding of learning outcomes and course engagement (Economou et al., 2017; Kumar et al., 2019; Soffer & Cohen, 2018). However, achieving a level of understanding with the technology is essential for students to be able to learn from the multimedia technology in the learning environment (Huang & Liaw, 2018; Park et al., 2019). Visual thinking, visual learning, and visual communication refer to the abilities to see what is being referenced, learn from the images that are showing how to do something, and communicate the information from a visual component. Understanding how people learn through content that provides multimedia content is essential to designing learning environments (Mayer, 2008; Zhang, 2018).

In addition to hypermedia development, understanding how the brain processes the media is another element that plays a significant role in the development process (Mayer, 2008). The five principles that reduce extraneous processing and lead to enhanced cognition are the following: (1) a concise lesson compared to an extended lesson, (2) narrated animation, (3) narrated lesson, (4) animation and narration (no text), and (5) caption and image placed together and narration provided at the exact time of animation. The three principles for managing essential processing are segmenting, pretraining, and modality, while the two principles for creating generative processing are combining words and pictures and conversational style narration. As technology continues to develop, the research connected to brain processing through interactive assets requires intentional design by creating a plan for the curriculum, applying the technology to the content, and assessing the performance of the online student.

Online learning environments that incorporate a strong mix of hypermedia and intentional design connect to the fundamental components related to the learning benefits associated with project-based learning, experiential learning, and the constructivist theory
(Guney, 2019; Kumar et al., 2019). However, faculty members have to have the tools, infrastructure, and proper support to provide robust learning environments that foster connection, increase dialogue, and make use of design elements for robust online learning (De Paepe et al., 2019; Lee et al., 2016; Morgado et al., 2017). One of the main benefits of a face-to-face learning environment is that students have the ability to interact with curriculum within a provided space (Cohen et al., 2018). The online student is required to not only retain information provided by the teacher but make sense of the knowledge in an autonomous space, which can create feelings of isolation, lack of motivation, and disconnect between the teacher, classmates, and course content (Gregori et al., 2018). Using VR to create VLEs with intentional design elements not only decreases the transactional distance for the student, but the structure of the space enhances cognitive understanding of topics.

**Design Elements of Learning**

Developing an immersive online learning environment comprised of elements associated with narration, text graphics, images, and autonomy leads to increased learning (Jensen, 2017; Kumar et al., 2019; Soffer & Cohen, 2018). However, how the narration, audio, animation, text, graphics, and images are combined plays a role in the brain’s processing of information. To understand how multimedia design principles impact visual and verbal processing and active learning, a study was conducted with 52 college students (Mayer et al., 2003). In multiple experiments, the results supported cognitive theory. All the participants performed higher on the problem-solving transfer test when they received a lesson in narration and animation, learner autonomy over pace of the lesson, and a pre-video lesson on topics. The conclusion supports other instructional design principles connected with the self-explanation, interactivity, and modality principles that enhance learning (Jensen, 2017; Zhang, 2018).
Computer-based interactive visualization has been recommended as an instructional aid to increase learning and retention for students (Cohen et al., 2018; Evans & Gibbons, 2007). Using a test score as the independent variable, Patwardhan and Murthy (2015) placed 134 engineering students in four groups—featuring non-interactive visualization, animation, simulation, and interactivity-enriched visualization—to understand the learning benefits of interactive visualizations. The non-interactive visualization used still images to explain the learning material. The animation group received the content with animation that offered play, pause, and stop options. The simulation group learned with an interactive manipulation with the option to shift things around when changing the course content. The interactivity-enriched visualization allowed multiple manipulations with the ability to change the varying degrees of the objects. The more the students could interact with the learning, the higher level of knowledge was gained and retained, as also found in the studies by Shin (2017) and Zhang (2018).

Patwardhan and Murthy’s findings supported Mayer’s (2008) 10 principles for designing learning environments, Guney’s (2019) focus on using hypermedia to enhance learning, and Mayer et al.’s (2003) findings connected to media in the curriculum and enhanced learning.

In addition to media as a design element, interactivity within the learning environment has been found to be essential to enhancing cognitive understanding and increasing engagement. To determine the relationship between interactivity design and increased recognition, 33 undergraduate students were placed in two groups to test the difference in learning for students who were involved in interactive (I) and non-interactive (NI) learning (Evans & Gibbons, 2007). The NI group received a lesson only through reading and images of a bicycle pump. The I group received a lesson that required them to click on the image and interact with the various labels to receive a definition of the item. The posttest provided five open-ended questions to determine
retention of the lesson. The I students performed better on the posttest compared to the NI group; however, there was not a difference in retention levels. The I group also took longer to complete the lesson, highlighting the extra time spent on the content, which impacted the final grades. Overall, interactivity in a lesson increased the time spent in the activity and correlated with an increase in cognitive understanding; however, the research was inconclusive on how VLE decreased the transactional distance for students.

**Conclusion**

The connection between the structure of the VLEs and deeper learning needs to be a main focus as emerging technology continues to move into the education sector. Learning increases when the instructor develops a course that uses interactivity, hypermedia, and principles associated with brain processing to engage the learner. The instructor is also responsible for ensuring that the course requires hands-on activities, project-based learning, and experiential learning to influence the connection between the student and the course material. In addition to interactive learning environments, faculty members have to work together to share resources and communicate technical needs to ensure that these environments are utilized in multiple formats. The cost of VR and the development of VLEs are on the decrease; however, sharing resources will save money and naturally create a community of practice in education.

Online learning does not have to lack the design that can be found in the face-to-face environment. Modern-day technology has continued to play a role in removing barriers for the online learner. With the increase in online enrollment over the years, educators need to understand how to use many of the same teaching methodologies and design principles to remove any additional barriers still holding the online environment back from converging with the face-to-face space (Soffer & Cohen, 2018). Educators have a natural desire to see students
academically succeed, and with the proper support and guidance, online students have the ability
to experience education in ways similar to campus students. Online learning has the capacity to
offer robust learning and interactions between peers through emerging technology, and with the
proper support, educators and administrators can create active learning environments that model
the same characteristics as campus to decrease the space the online learner experiences.

Literature Review Conclusion

The evolution of technology in education is one constant in an industry that was created
to bend and mold to the needs of society. The birth of online education was generated by the
people in society who were looking to go back to school and have the flexibility of on-demand
learning. Online education would not have been able to develop without technology
enhancements that supported the ability for students to learn as long as they have a computer and
access to the Internet. With the growth in education and technology, administrators can look at
how educators will be trained to support advances in technology. Research on technology, such
as VR, needs to be done to ensure tools are being implemented to maximize benefits for the
learner. Research theories that focus on online education will need to be examined to ensure that
they provide a framework that will meet the needs of relevant research, so that administrators
and educators can make better decisions related to technology and learning.

The technology of the 21st century continues to grow and provide a way to move learning
from a 2D environment into an actual 3D environment through the advancements made with VR.
To transition to this immersive form of learning, educators are being asked to adopt pedagogy
that uses technology to enhance online student engagement, motivation, and cognitive
understanding. The knowledge gap between educators and 21st-century learners continues to
expand as students enroll in college with knowledge available to them on-demand. As a result,
educators need training focused on how to use immersive technology to develop courses and curricula that meet the needs of current and future learners.

Since the development of technology, VR is the first tool that has the ability to make online students feel as if they are in the learning environment with their peers, regardless of their physical address. Learning behaviors such as motivation, communication, creativity, development of empathy, and cognitive enhancements have been connected to positive research with VR in education. However, the adoption of VR in education will need to be influenced by educators since they oversee courses and curricula. The design of VLEs will also be essential for students to feel connected and engaged with the course material, so that motivation levels are enhanced and SRL is developed, creating the skills needed for more well-prepared college students.

Education has been predicted to become one of the main industries that will be disrupted due to emerging technology. When it comes to attrition and persistence, online learning has always struggled to meet the same academic threshold as the campus environment, leaving a large gap between campus and online students who are able to graduate. However, online enrollment continues to rise with the growth of technology in education (Dumford & Miller, 2018; Gregori et al., 2018; Shaw et al., 2016). With current research providing positive outcomes related to VR in education, knowledge about VR for distance education could be advanced through a research study focused on the connection between VR and distance learning based on the lived experiences of the online students.
Chapter 3: Methodology

The interpretative phenomenological analysis (IPA) method (Smith et al., 2009) was utilized in this study to explore how virtual reality (VR) impacts online students’ connections to the course structure, feelings of autonomy, and interaction with both peers and teachers. This chapter presents the rationale for using the constructivist paradigm to develop a qualitative study, followed by descriptions of the theoretical underpinnings of IPA, the research site, and methods for how the participants were selected and protected. This chapter also describes the data analysis process and steps to enhance trustworthiness and validity. Finally, limitations of the study are discussed.

Research Approach

A qualitative research approach was chosen for this study. Qualitative research aims to provide a rich description of a phenomenon of study. The data collection took place via a videoconferencing tool, with the researcher and the study participants working together through a conversation to make sense of the phenomenon. Qualitative research studies describe people’s lives, actions, behaviors, and interactions; each stage of a qualitative study is designed to highlight various characteristics of the research process (Creswell, 2012). The philosophical understanding of a qualitative research approach stems from the narrative and in-depth description of the participants’ experience (Creswell, 2013; Roberts, 2010). This research design is useful when researchers seek an authentic understanding of the phenomenon. Broad and general questions were used in this study to understand the lived experiences of the research participants (phenomenology).
To date, the research centered around VR for learning has focused on behaviors that are associated with the use of VR in learning, such as increased motivation, increased course satisfaction, and improved cognitive understanding of specific topics. Limited research has been conducted to understand how students experience VR in the online environment. A qualitative research approach in which student research participants are interviewed allowed for the exploration of the various ways that online learners experience VR.

**Research Paradigm**

A research paradigm is “a set of beliefs about the way in which particular problems exist and a set of agreements on how such problems can be investigated” (Fraser & Robinson, 2004, p. 59). The philosophical underpinnings of a research paradigm are different approaches to developing, conducting, and making sense of research. Research paradigms are used to assist in categorizing various ways research studies are completed from start to finish. Merriam (1991) referred to the categorizing of research as establishing a “knowledge base” and noted that each of the various elements in the paradigms contribute to the knowledge that is gained through research.

The positivism paradigm is systematic by nature, verifies an established hypothesis, and can be related back to a data set that highlights a relationship between the data and hypotheses. Criticism of the positivism paradigm has highlighted the restrictive nature of the scientific method when studying a social phenomenon. The constructivist paradigm is a “response to the over-dominance of positivism” (Grix, 2004, p. 82). The constructivist framework places an emphasis on the individual and connects with the idea that there are multiple realities to be constructed.
This study followed a constructivist paradigm. The constructivist paradigm acknowledges the unique experience of each individual who utilized VR while taking an online course. Furthermore, the paradigm provides a methodology framework for qualitative research that is inductive and supports the hermeneutic cycle in IPA (Rehman & Alharthi, 2016).

**Research Tradition**

IPA is a qualitative research tradition rooted in hermeneutics, phenomenology, and idiography (Smith, 2011). The philosophical underpinnings of IPA stem from phenomenology, which originated from a reflective lens to conduct research (Van Manen, 2014). IPA is used by researchers to make sense of how participants experience a phenomenon (Smith, 2011). The evolution of phenomenology from a philosophical discipline to a form of interpretative analysis emerged from researchers in the 19th century with a background in psychology, who sought to understand participants’ individual lived experiences and how meaning is formed (Dowling, 2007; Smith et al., 2009). IPA research pulls from an in-depth meaning-making process generated by the participants of the study during the interview (Pietkiewicz & Smith, 2012). The researcher examines the unique experience provided by the participants to discover general themes associated with the phenomenon (Pietkiewicz & Smith, 2012; Usher & Jackson, 2014). This process is tied to a hermeneutic perspective (Smith et al., 2009).

**Phenomenology**

The philosophers most associated with phenomenology are Husserl, Gadamer, and Heidegger. Husserl’s work focused on the reflection of the individual, while Gadamer’s and Heidegger’s work focused on the interpretation of the participants’ sense-making (Pietkiewicz & Smith, 2012; Smith et al., 2009; Thomas, 2003; Usher & Jackson, 2014). Husserl is the godfather of phenomenology, who focused on understanding the individual experience of a phenomenon.
and how that experience is unique from others (Pietkiewicz & Smith, 2012). Husserl also focused on the researcher’s understanding of the phenomenon from an unbiased approach in order to let the phenomenon emerge, which led to *phenomenological reduction* (Dowling, 2007). Phenomenological reduction ensures that the phenomenon is viewed from various lenses and requires researchers to set aside their assumptions to understand the essence of the participant’s experience in the event (Smith et al., 2009).

There are distinctive connections between IPA and phenomenology; however, different researchers have different approaches to the methodological analysis based on a positivist, post-positivist, or interpretivist paradigm. As a postpositivist, Husserl viewed epistemology as the key to understanding a phenomenon, which is in contrast to Heidegger’s ontological approach that focuses on the organization of reality (Laverty, 2003). Heidegger considered understanding to be a reciprocal activity and the lived experience to be an interpretative process (Dowling, 2007).

*Hermeneutics*

IPA also stems from hermeneutic phenomenology, the interpretation of lived stories, text, and historical documents (Smith et al., 2009). Gadamer and Heidegger viewed the personal and social as connected components of the research (Larkin et al., 2011). Gadamer and Heidegger moved phenomenology away from an eidetic description to a more interpretive nature, which is what created the gap with the hermeneutic researchers and Husserl’s original thought (Smith et al., 2009; Usher & Jackson, 2014). Heidegger recognized that the level of reflexivity was connected to an individual’s engagement in the world and the in-depth interview process created the space for reflection (Javornicky, 2018). Heidegger and Gadamer believed that a person and researcher are connected to the experience and have knowledge of the phenomenon for true
sense-making, which is in opposition to Husserl’s concept of bracketing (Usher & Jackson, 2014).

Gadamer viewed hermeneutics as a co-creation between the participants and researcher and that the sense-making occurred through reflective writing and interpretations and cycles of reading (Van Manen, 2014). This process allows the understanding of the experience to be ongoing and moving back and forth between parts of the conversation to the whole discussion. Gadamer saw interpretation as an evolving process and emphasized the importance of questioning to engage part of the interpretive process (Laverty, 2003).

IPA is focused on pulling from the quality and texture of participants’ experiences through a productive dialogue, while acknowledging that the experience is not something that the researcher can recognize within the conversation, and openly accepts that the opinion and experience are not separated (Javornicky, 2018). The researcher is involved in a double hermeneutic because the participants are making meaning of their world while the researcher is trying to decode the essence to make sense of the participants’ meaning-making (Smith et al., 2009). IPA is a descriptive and interpretative process that honors the participants’ movements and ideas that are part of the sense-making process (Laverty, 2003).

IPA embeds the researcher’s bias and assumptions in the interpretive process; however, the researcher is actively engaging in a reflexive process while conducting interviews with the participants to understand how the bias is impacting the research (Laverty, 2003). Through the hermeneutic cycle, the researcher co-constructs data with each participant. The multiple stages that the researcher engages in during an IPA study are critical to the research and are the central distinction between IPA and other types of phenomenology.
Idiography

The analysis of an IPA study is complex and can be time-consuming while also inspiring in nature. The researcher became immersed in the data for each participant to seek evidence of how the participant made sense of the phenomena while engaged in a reflective process, creating an emic and etic relationship between the researcher and the data (Pietkiewicz & Smith, 2012). IPA has a flexible structure to allow the researcher to move between iterative and inductive cycles. Each interviewee’s story was analyzed line-by-line, providing the claims and understandings related to the phenomenon, which developed the themes of the research (Creswell, 2013). The themes were developed through the participants’ narratives and are supported by direct quotes from the interviews (Pietkiewicz & Smith, 2012).

Idiography focuses on the detailed information provided by the participants when describing their relationship to the topic of study. In addition, the researcher gave specific attention to the single story, while also understanding how the participants’ unique experiences played a role in their connection to the phenomenon. Idiography ensures that the researcher does not create generalizations about the topic and that the data analysis is credible and can be verified at any time (Smith et al., 2009).

The design of an IPA study provided the framework for the researcher to make sense of how VR impacts online students’ connections to the course structure, feelings of autonomy, and interaction with both peers and teachers. The process between the IPA design and the participants’ individual stories provided an enriched understanding connected to emerging technology in online learning.
Research Site

The research site for this study, hereafter referred to as “the university,” is located in the southeastern United States. The university was founded by offering recording workshops to students. In 1980, the curriculum was expanded to include video and film production degrees. At the time, the only admission requirement was that students must have a standard High School diploma or a General Equivalency Diploma from an accredited school to enrol in a degree program. In 2007, the university expanded its degree offerings by providing online programs, and it now has a student body of 21,114, comprised of online and on-campus students. The university is nationally accredited and offers associate, bachelor’s, and master’s degrees.

The university offers educational programs at an accelerated pace with courses starting and ending every four weeks. This accelerated pace attracts students to the university, in addition to the fact that online bachelor’s degree programs can be completed in 29 months and an online master’s degree program can be completed in 12 months. On-campus students are expected to attend class Monday through Sunday with scheduled classes around the clock. Online students attend weekly lectures via a video conferencing tool and have weekly due dates for assignments and discussion posts. The university is connected to forward-thinking learning environments and has created an ideal environment to study how online students experience VR for learning.

The degree program used for this study provides courses for online students that focus on game development with a heavy emphasis on systems and level designs that help students understand how to develop and build games. The curriculum is scaffolded to provide an understanding of game mechanics, design fundamentals, interfaces for communication, and group collaboration to develop a working game before graduation. The students who enter this degree have a passion for gaming or learning about game mechanics in a hands-on learning
environment. The online program implemented VR in a capstone course in the first six months of the student’s journey. This specific course requires students to develop a basic game using knowledge gained from the prior courses that focus on game mechanics, communication, and mathematical reasoning.

**Participants**

The target population for this study was students enrolled in the 29-month online Bachelor of Science (BS) degree program. The selected participants completed an online course that utilized VR to connect with students. The course selected for this study is offered in the 16th month of the 29-month program. The teacher of the course was not involved in the study. Traditionally, the number of participants can range in size; however, IPA recommends a small sample due to the analysis of the rich interview content (Smith, 2011). Therefore, nine online students who had experienced VR in the online course were recruited and enrolled as participants.

The participants were selected purposively and from a homogeneous group. Purposive sampling is ideal for IPA research because the goal is to include participants who have experience with the phenomenon under study (Smith, 2011). A homogeneous sample is ideal for an IPA study because the data analysis process should focus on finding common themes of those who have a similar experience with the phenomenon of study (Creswell, 2013).

Purposeful sampling needs to be coupled with a strategy to ensure the sample demonstrates the desired criteria (Creswell, 2012). Therefore, a criterion-based sampling strategy was used to identify study participants. The following criteria were used to identify participants for the study:

- At least 18 years of age,
Currently or previously enrolled in the university’s BS online degree program,

Enrolled in or completed the online course that utilized VR for learning within 15 months of the study,

Utilized VR during the online course,

Agreed to audio and video recording of the interview, and

Agreed to publication of the data collected from this study.

**Recruitment and Access**

Participants were recruited using an internal document program, CampusVue (Version 12.9.1), by the researcher. To receive a report of all of the students in the BS online program, a specific code was utilized to generate a CampusVue report with the population. Once the population information was collected from CampusVue, a recruitment email was sent to the online students who were enrolled in or had completed the course utilizing VR within the past 15 months (Appendix A). The recruitment email provided a brief description of the study, the criteria to participate, and a request to respond to the email to schedule a time to be screened for the study. The researcher reviewed all participants against the criteria set for the study to confirm that each online student selected was eligible to participate. Upon screening, each participant who met the predetermined criteria was asked via email to schedule a 60-minute online interview at a time of the student’s choosing using the videoconferencing tool Zoom (Appendix B). The participants signed a consent form before the interview started (Appendix C). Each of the participants was given a pseudonym to ensure confidentiality before the start of the interview. All identifying information about the participants was removed from the transcripts. Data anonymization was utilized throughout the research process to ensure anonymity of the participants.
Data Collection

One of the central tenets of data collection for an IPA study is to engage participants in in-depth interviews to provide a detailed, rich, first-person account of their experience with the phenomenon under study (Smith, 2011). During the interview process of an IPA study, participants are encouraged to reflect on their experiences, tell stories, and express honest thoughts related to the experience. To pull rich data from the participants, the researcher provides a variety of questions designed to connect to the experiences that are familiar to the interviewee (Rubin & Rubin, 2005).

Each of the selected online students completed a semistructured, one-on-one, video-recorded, 60–90-minute interview (Appendix C). The interview started with broad questions to help the researcher gain an understanding of the topic from the participant’s perspective (Rubin & Rubin, 2005). Within the set of questions, probing questions signaled the interviewees to expand on the question or provide more insight that the researcher deemed important to the overall study. Probes were also used to help manage the conversation and allow the researcher to seek more information on an unclear response (Rubin & Rubin, 2005). The participants were asked six to 12 questions, depending on how much information the interviewee was providing (Smith et al., 2009). The first questions created familiarity between the participant and the researcher. To help mitigate bias on the part of the researcher, a reflectivity practice took place as the questions were drafted and the data were transcribed.

Data Storage

A copy of each interview recording was saved to a desktop folder that is password-protected on the researcher’s password-protected computer. Recordings were professionally transcribed by Rev.com and de-identified. A pseudonym was assigned to each participant to
maintain anonymity. A copy of the interviews was stored on an external hard drive that is password-protected. All physical data were kept in a locked location for the entirety of the research study to which only the researcher has access. Once the data had been properly secured, the process for the data analysis began. Upon completion of the study, the data and associated documents were retained in a locked filing cabinet in accordance with IRB requirements.

Data Analysis

The first step in the data analysis process was to listen to the audio recordings of the interviews and read the transcripts multiple times (Pietkiewicz & Smith, 2012; Smith, 2011). The goal during this immersive process was for the researcher to take notes on observations and reflections from the interview or anything else that seemed significant to how the participants experienced the phenomenon. The note-taking process moved from a descriptive, linguistic process to a conceptual, commenting process. Once the researcher had taken notes, that material was organized into emerging themes or phrases. Finding emerging themes involved attaching a descriptive label to similar emerging topics and seeking out clusters and connections (Pietkiewicz & Smith, 2012). Each level of this process provided information to creating the themes and was essential to identifying recurrent themes across each interview. This study used a general inductive approach that follows the systematic procedures connected to an IPA study (Thomas, 2003).

A post-coding transition focused on code charting encouraged the use of a table to collect the participant’s paragraphs into one column with significant codes in the adjoining column (Saldana, 2016; Smith et al., 2009). Saldana (2016) noted that this approach is best when the study includes multiple interviews to code. The visual representation allowed the researcher to construct patterns among the interviews and see the various codes developed from the
transcripts. IPA has flexible guidelines and encourages the researcher to be creative when finding ways to connect with the interviews (Pietkiewicz & Smith, 2012).

**Step 1: Reading & Rereading**

Data analysis began with reading the interview transcripts multiple times (Smith et al., 2009). Once the transcript was read multiple times, the researcher took notes by writing short phases, ideas, and key concepts to engage in proper “memoing.” The goal of memoing is for the researcher to continue with the process of becoming familiar with the participant’s story (Smith et al., 2009). This process also ensured that the researcher engaged with the materials and did not take a passive stance, which is common when reviewing interviews. Reviewing the memos also allowed the researcher to discover categories or themes that were represented in each of the transcripts. The researcher used descriptive comments, linguistics comments, and conceptual comments throughout the note-taking process to properly engage with the data. Van Manen (2014) refers to this as **thematic draft writing**, which is reflecting on the compelling and recognizable anecdotes that connect to the main phenomenon.

**Step 2: Interpreting the Data**

After reading and memoing, the researcher engaged in the classification, description, and interpretation phase of the analysis of data pulled from the notes. Once the researcher engaged with the transcripts and moved through the various memoing strategies, the next step reduced the level of notes by mapping the patterns, connections, and interrelationship between the notes. This process is reflective of the hermeneutic cycle, which is the process of fragmenting the flow of the narrative from the participants to discover sets or parts of the data that came together in the final analysis. Throughout the process, themes were verified in other interviews from the study. This
process occurred multiple times throughout each interview, resulting in the removal of notes and personal questions from the initial coding process.

**Step 3: Developing the Themes**

Themes are found in qualitative data by synthesizing the notes from the individual interviews. The themes were reviewed for function and contextualization. Identifying five to seven themes is a popular approach for many qualitative researchers (Creswell, 2013). However, not all themes have to be utilized, according to Creswell, and many might be discarded as the researcher moves through the data analysis process. The final phase reviewed the individual themes to discover patterns from the combined stories. Discovering patterns from the collective moves the analysis to a more theoretical level.

**Positionality of the Researcher**

My experience as a student in the K-12 public education system was rooted in pedagogical strategies that fostered memorization techniques and measured achievement with standardized tests. It was not until I was in college and started to take a combination of face-to-face and online classes that I realized the traditional style of teaching that was popular during my adolescence did not foster a learning style that was conducive to learners like myself. During college, I enrolled in courses that were engaging, used innovative pedagogy, and provided multiple options for students to complete assignments. Once I understood a teacher’s power in fostering learning, I became enamored with the idea of working in education to help create learning environments that serve all students.

In 2007, I started my journey in higher education as a staff member at a higher education institution that offers associate’s, bachelor’s, and master’s degrees. The approach to education at my institution focuses on providing students a real-world industry experience. The curriculum is
designed to provide students the knowledge and skills to gain employment in all areas related to technology, media, and entertainment. Since 1980, the university has used technology to facilitate learning and create a hands-on learning environment. It is not uncommon to see students using VR or AR in courses to better understand how to make games or other forms of entertainment for the future.

**Beliefs, Biases, and Opinions**

With my professional experience rooted at an innovative school, I am quick to experiment with new teaching practices and explore creative pedagogical practices that fit the needs of the evolving student. I view VR as an innovative tool that can be used to bridge the gap in curriculum between active and passive learning. The emergence of VR in education speaks directly to my passion of creating unique learning environments to make learning engaging for all students. However, my experience with VR is minimal compared to that of students who have grown up playing video games and colleagues who worked in the gaming and technology fields.

Educators introduce technology in courses and thus increase materials cost for the students without having data to support how the tool can enhance students’ learning experience. As a result, students are required to purchase and download learning tools without consideration given to the cost to the university or the learner. Educators and administrators often make decisions related to technology and teacher education programs that lack relevant data to support a new teaching and learning tool. To isolate my bias towards my data collection and research, I practiced reflective journaling to monitor my thoughts and internal dialogue during and after I conducted each interview.
Trustworthiness and Verification

While IPA is seen as a creative process, the IPA researcher needs to give attention to how the data will be validated in the body of the literature (Smith et al., 2009). The accuracy or credibility of the research needs to be confirmed through analysis at multiple stages of the research process, according to Smith et al. Starting with the research question, moving to the research design process, and finishing with the analysis of the data constitute a repetitive process of establishing validity. Credibility and dependability of this study were established though use of the following steps.

Researcher Bias

It is only through observing and reflecting on a person or situation that one can start to peel back the layers and see how perspective plays a role in what is being perceived. Not only is observing the environment essential, but examining one’s own positionality related to what is taking place is also crucial to the process of conducting a research study (Takacs, 2002). For this subject of study, the researcher’s beliefs and biases about education and the use of technology have been disclosed. To mitigate bias as the data analysis was taking place, the researcher engaged in a reflective journaling exercise as the coding process was taking place.

Rich, Thick Description

An IPA study is rooted in the understanding that a rich, thick description of the lived experiences of the participants regarding the phenomenon of study is essential to capturing the characteristics of the story (Van Manen, 2014). The ultimate goal is that the description is in such detail that a third person can read the experiences and understand the moving parts that have created that story. While the researcher is documenting the lived experiences of the participants, the researcher is always capturing their own understanding, which allows them to
move between the emic and etic cycle of the interview process that is true to an IPA study (Pietkiewicz & Smith, 2012). The rich, thick descriptions allow readers to determine the transferability of the stories (Creswell, 2013; Smith et al., 2009). The detailed descriptions of the participants allow those reading to replicate the stories in context similar to other studies. Details are pulled from the interviews and coded to highlight the description of the physical movement and activity. The description with details moves from a general approach to the specific by using strong action verbs and quotes (Van Manen, 2014).

**Reflexivity**

Constructivist researchers are aware of the control provided to the participants to allow them to feel safe and honored by having their stories captured (Agee, 2009). The dialogue during a meeting connects to the primary mode of communication between humans, which demonstrates the power of an interview (Kvale, 1996). A controversy about a qualitative study approach is connected to the idea of who has the control when the researcher has selected the questions, the participants, and the way the data will be collected (Lincoln et al., 2011). Engaging in reflexivity during the study reminds researchers that they are fluid within the capturing of the story. The researcher evaluates how one’s own bias might be highlighting themes that fit in the participant’s story and the researcher’s story (Smith et al., 2009). With researchers engaging in a reflexivity exercise while moving through the interviews, researchers will have a strong understanding of the difference between their own story and the capturing of the lived experiences for each of the participants (Lincoln et al., 2011).

**Protection of Human Subjects**

When designing an IPA study that requires human participation, requirements regarding privacy, confidentiality, and informed consent are needed prior to beginning the research (Smith
et al., 2009). It is important for researchers to acknowledge the positionality they bring to the study, while also disclosing the overall objectives to the participants through an informed consent process. Institutional Review Board (IRB) approval was obtained before the participants for the study were contacted. The researcher obtained consent prior to interviewing the participants.

An IPA study needs to pay extra attention to disclosing the process of the study to the participants. Establishing an informed consent at the start of the study ensures trust and an understanding of the parameters of the study. All participants were able to remove themselves from the study at any time without question. To ensure protection of each of the participants, the researcher has kept the participants’ names confidential.

**Limitations**

Critics of qualitative studies argue that the nature of transcribing can be open-ended and lack structure compared to a quantitative study (Usher & Jackson, 2014). In addition, a qualitative study typically has a small sample size. The research site for the study also has a short schedule with classes lasting only four weeks. The short courses create a unique experience for the participants experiencing the phenomenon that will be hard to transfer to other settings. The VR environment that the students experience is also for curricula on gaming, which makes it challenging to generalize the findings to other learning environments. One of the main limitations of this study is that, to date, there were few studies available focused on the lived experiences of online students who utilized VR for learning, which required the literature review to synthesize the topics of online learning and VR separately to determine how the learning tool impacted online learners. There are few studies that could be used to compare to the current topic of study and validate the findings from other research.
Conclusion

Technology plays a significant role in the changes taking place in the entertainment industry, medical field, and education. Studies have demonstrated the powerful benefits of using VR for learning (Akbulut et al., 2018; Chang et al., 2016; Huang & Liaw, 2018); however, little to no known research has been conducted to understand the lived experiences of online students who are using VR. Much of the research focused on the impact of VR has revolved around academic performance and student motivation factors, with the research site connected to campus students. Understanding how online students are experiencing VR as a learning tool can provide educators with information that can bridge the gap between campus and online learning.

The participants for this study had little time for reflection on how they felt during the course that utilized VR, and many of the participants were making sense of their own story as they reflected on the experience. The research approach for this study was designed to create structure with the interview questions using the transactional distance theory (TDT) framework. The use of the TDT framework mitigated the limitations associated with a qualitative study, which can be criticized for not having enough structure to create clean data (Smith et al., 2009; Thomas, 2003).

The theoretical underpinnings of an IPA study played a role in how the participants’ stories were reviewed for data translation. The considerations connected to participants’ confidentiality and data storage of the interviews established trust and confidence between the researcher and the students. The data collection process for an IPA study required that the researcher employed a slow and methodical process to the data translation to ensure the participants’ stories were accurately captured and translated into themes. While every participant had their own experience with VR in the online setting, the data process was developed to
accurately capture the individual stories while being able to bring all of the main themes to the surface.

This study was designed to give voice to online students and how technology has impacted learning. This body of research will allow those in higher education to understand how VR has impacted grades and student motivation from a qualitative perspective, in addition to how students experience VR in an online environment.
Chapter 4: Analysis of Findings

The purpose of this interpretative phenomenological analysis (IPA) was to explore the lived experiences of online students who used virtual reality (VR) to attend a series of one-hour VR online lectures that were taught by an instructor in a virtual learning environment (VLE) platform. Transactional distance theory (TDT) served as the lens for interpreting the participants’ responses. Nine students opted to participate in the study, and an interview was conducted with each participant. Three superordinate themes and eight nested subordinate themes were uncovered through an intentional analysis to understand how learning in a VLE impacted online students’ experience related to dialogue, structure, and autonomy, as found in the TDT theory (Moore, 1997).

This qualitative study was guided by the following research questions:

What are the experiences of online students enrolled in a Bachelor of Science degree program who utilized virtual reality?

Sub-Question: How does virtual reality impact online students’ connection to the structure of the academic course?

Sub-Question: How does virtual reality impact online students’ feelings of autonomy?

Sub-Question: How does virtual reality impact online students’ interaction with both peers and teachers?

The aim of this chapter is to report the results of this study by providing a concise review of the profiles of the research participants. The data analysis is discussed to highlight how the themes were developed and identified. A review of the results describes the three superordinate themes and seven subordinate themes. The chapter concludes with additional findings and a summary of the themes.
Participant Profiles

Nine online students were purposefully recruited following Institutional Review Board (IRB) approval. All of the participants were online students who had taken and completed a course that utilized VR to teach course concepts, answer student questions, and highlight the weekly assignment requirements. All of the participants were enrolled in the same online degree program focused on game design. Two of the participants were female, and seven were male. Participants’ ages ranged from 25 to 43, and each participant completed the course with a passing grade. The average final grade was 86.75%. All participants met the established criteria to participate in the research, as described in Chapter 3. All participants were given pseudonyms to maintain confidentiality. Table 1 displays selected participant characteristics.

Table 1

<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>Location</th>
<th>Final Course Grade</th>
<th>Prior Experience with VR?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheryl</td>
<td>30</td>
<td>Arizona</td>
<td>91.25</td>
<td>No</td>
</tr>
<tr>
<td>David</td>
<td>41</td>
<td>Arizona</td>
<td>82.50</td>
<td>No</td>
</tr>
<tr>
<td>Earl</td>
<td>27</td>
<td>Virginia</td>
<td>94.00</td>
<td>No</td>
</tr>
<tr>
<td>Joe</td>
<td>25</td>
<td>Arizona</td>
<td>87.60</td>
<td>No</td>
</tr>
<tr>
<td>John</td>
<td>35</td>
<td>Indiana</td>
<td>87.70</td>
<td>No</td>
</tr>
<tr>
<td>Larry</td>
<td>34</td>
<td>Georgia</td>
<td>79.55</td>
<td>Yes</td>
</tr>
<tr>
<td>Mike</td>
<td>30</td>
<td>Pennsylvania</td>
<td>80.25</td>
<td>Yes</td>
</tr>
<tr>
<td>Shawn</td>
<td>43</td>
<td>Texas</td>
<td>96.75</td>
<td>No</td>
</tr>
<tr>
<td>Suzie</td>
<td>43</td>
<td>Texas</td>
<td>96.75</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Cheryl

Cheryl did not have prior experience with VR; however, she indicated that she intended to make educational VR games once she completed her degree. She sought out online learning for flexibility, so that she could work, care for her children, and earn her bachelor’s degree in computer programming. Her biggest challenge as an online student was the lack of connection she felt with teachers occasionally. Cheryl desired a connection with her classmates and teachers and worked hard in the online space to develop these relationships by asking her teachers questions and connecting with students who live near her. Upon hearing she would be using VR in one of her online courses, she said, “I was excited. It can be a bridge for people that are visual learners. It will give them [online students] more control, and I love that.”

David

David did not have prior experience with VR before he was enrolled in the online course that used VR for teaching and learning. When he learned he would be using VR in one of his courses, he said, “I had mixed emotions at first not knowing what I would be like, but I was like a little child at Christmas when I got the VR package.” David had attended other colleges in the past and said he considers himself a lifelong learner. He wanted to be an on-campus student; however, the online program provided him the flexibility to work while going to school, and he did not want to move from his home state. David also suffered a brain injury from his time in the military and felt that learning on-campus would have provided him a more interactive environment. One of his challenges as an online student was not receiving help right away. He also found it hard to ask specific questions through messages.
Earl

Earl did not have prior experience with VR; however, he indicated that he is adept at using technology and built his own computer. He said when he received the VR headset for class he was excited to get started, “It was absolutely cool, and I immediately downloaded it [the VR software] and it was a blast.” He wanted to be an on-campus student but was unable to move to Florida. Earl acknowledged that being an online student provided him the flexibility needed to work while going to school. He struggled with time management and not having the necessary hours to focus on schoolwork. He was in the military and enjoyed the structure that was required of him during that time.

John

John did not have prior experience with VR before he was enrolled in the online course that used VR for teaching and learning. He had attended three colleges prior to enrolling in the online game design program. He enrolled in an online program seeking flexibility to help him balance work and family while seeking a bachelor’s degree. He acknowledged the effort it takes for online students to be successful saying, “Having a life, family, and taking classes, it takes a lot to be successful.” His biggest struggle as an online student was time management and having to learn content on his own. He indicated that he enjoyed the projects he gets to build and the pace of his courses. John recognized that it takes a lot of effort and organization to succeed as an online student.

Joe

Joe did not have prior experience with VR before he was enrolled in the online course that used VR for teaching and learning. He said he was “psyched” to learn he would be using VR in one of his courses. As an online student, Joe struggled with staying motivated to complete his
assignments, saying, “If I enjoy the assignment, I’ll get it done early, but if I don’t, I tend to procrastinate.” He is an online student, so that he has the flexibility in his schedule to complete class assignments on his own time. He was not employed at the time of the interview; however, he does work part-time from time to time, which is why online learning was best for him.

**Larry**

Larry had experience using VR through playing video games. Upon learning he would be using VR in one of his courses, he said, “I was excited to use it for something that wasn’t going to be for video games.” Larry was interested in how VR can create an authentic environment for people to work remotely. He enrolled in the online program seeking flexibility that allowed him to earn his degree while working 60+ hours a week and being available for his family. Larry had attended another college in-person and found it hard to balance school while also trying to work. His biggest challenges were the due dates for the assignments. He did his school reading using an iPad during his breaks at work or late in the evening. He was hoping for more flexibility with due dates; however, he understood the structure they provide for people with a busy schedule, like himself.

**Mike**

Mike had experience using VR through playing video games. Even with his experience using VR, he said he found use of the technology in education “to be cool and unique” and “was excited” when he heard it would be used in his online program. He indicated that he enjoyed the flexibility of being an online student. The schedule allowed him to work and care for his family while earning his degree. He was organized with his time and even had weeks when he got his work done in advance and was able to get started on the next week’s work early. He had not experienced any major challenges as an online student. His only challenge had been some
technical issues with his laptop over the past few months that caused him to request an extension from his teachers.

**Shawn**

Shawn did not have experience with VR before he was enrolled in the online course that used VR for learning. He said he was “excited to get the equipment and use the technology.” He worked for himself and found online learning to provide the flexibility he needed for his schedule, and he also enjoyed having a comfortable learning area. He stated that he enjoyed the learning videos and the course materials. One of the challenges he expressed was that he did the majority of his schoolwork late at night and found that he had to wait until the following business day to get a response to any of his questions. He had also had some technical challenges throughout his academic journey that caused him not to submit work on time.

**Suzie**

Suzie had experience using VR through playing video games. According to Suzie, the idea of using VR to learn “was interesting because I want to see how this actually works in a class setting.” She indicated that she enjoyed the flexibility afforded to her as an online student, so she can balance her work schedule with the needs of her studies. One of her biggest challenges was finding the motivation to do her work and not get distracted. She loves YouTube and playing video games, so she found it hard to put her schoolwork first. She felt that a campus environment would help motivate her and remove distractions when she was learning; however, she was not able to move to Florida to attend classes.

**Data Analysis**

The data analysis yielded three superordinate themes and seven nested subordinate themes (Table 2). Themes were developed through repeated review and interpretation of the
interview transcripts using Saldana’s (2016) and Smith et al.’s (2009) qualitative data analysis processes. The three superordinate themes constitute global or overarching concepts that were central to the participants’ experiences in using VR for online lectures. Table 2 displays the superordinate themes and the nested subordinate themes.

Table 2

Superordinate and Nested Subordinate Themes

<table>
<thead>
<tr>
<th>Superordinate Theme</th>
<th>Subordinate Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enhanced Student Learning</td>
<td>• Alignment with Learning Styles</td>
</tr>
<tr>
<td></td>
<td>• Ease of Communication</td>
</tr>
<tr>
<td></td>
<td>• Enhanced Concentration</td>
</tr>
<tr>
<td>Presence of a Learning Community</td>
<td>• Classroom-Like Environment</td>
</tr>
<tr>
<td></td>
<td>• Deeper Connections with Classmates and Instructor</td>
</tr>
<tr>
<td>Technology</td>
<td>• Cybersickness</td>
</tr>
<tr>
<td></td>
<td>• Lack of Seamless Transition</td>
</tr>
</tbody>
</table>

Enhanced Student Learning

The first superordinate theme to emerge was Enhanced Student Learning. Each of the participants discussed how the VLE impacted their ability to concentrate, learn in a manner that was connected to their self-identified learning styles, and enhanced their desire to engage with the course. A cross-case analysis of participants’ responses revealed the shared experience of enhanced student learning. Within this theme, three subordinate themes emerged: Alignment with Learning Styles, Ease of Communication, and Enhanced Concentration.

Alignment with Learning Styles

The subordinate theme Alignment with Learning Styles emerged as participants shared their experiences in the VLE. During the interviews, participants mentioned their self-identified
learning styles as hands-on, active, kinesthetic, and visual. Participants also attributed their preferred way of learning as a reason why the VLE was impactful. Learning styles were mentioned without being prompted by the researcher. Mike, who self-identified as a visual learner, seemed to have a stronger understanding of the VLE lecture material because of the way information was delivered. This was evident when he described how the VLE impacted his learning. Mike said,

Being able to watch the teacher code and build objects helped me understand the material because I am a visual learner. . . . I learned more in the [VLE] than if I was just straight reading something. . . . I got a lot more out of the experience since it was more hands-on.

Through the content design in the VLE, Mike was able to connect with the information in a way that differed from his other online lectures.

The VLE also served as a bridge between the content and the participants’ preferred way of learning. The VLE impacted Cheryl’s understanding of the material presented. Cheryl said, “I was able to practice what was being taught and get actual feedback on what I was doing. I am a visual learner and it felt like I had more control, and I love that.” The ability to actively engage and practice with the information being taught seemed to enhance Cheryl’s learning experience. Suzie also identified as a visual learner and found that the visual experience in the VLE increased her ability to retain information. When Suzie described how her teacher helped her learn in the VLE, she said, “He [the teacher] showed us step-by-step instructions on how to create an object.” Through this visual representation, Suzie seemed to have a better understanding of how to complete her own work. This became more evident when Suzie was asked how this impacted her learning. She said, “Being able to watch the teacher go over concepts helped me complete weekly assignments with fewer questions because if I have to read
something, it takes me a few more minutes to understand, especially when things are step-by-step instructions.” Suzie emphasized that the way the information was visually communicated in the VLE had a positive impact on her understanding of the course material. It was evident that her deeper knowledge of the material allowed her to feel confident when completing her work.

Similar to Cheryl and Suzie, Earl also credited his learning style as a reason he found the VLE to be beneficial towards his understanding of course content. He said,

[The VLE] appealed to my learning sense a lot better than watching a video or reading a document. I’m a lot more tactile. If I’m working directly in front of someone, it’s a lot easier for me to comprehend the situation than it is to read a document or listen to a lecture. . . . I was also able to use 3D objects to illustrate my questions.

Through the 3D visual representation of information, it became apparent that Earl connected with the content in a way that is unique to the VLE.

The way information was visually displayed and communicated allowed the participants to have a stronger understanding of how to complete a task. This was evident in Joe’s response when he shared how the VLE impacted his learning. Joe said,

I like seeing how something is done and then given instructions; it adds more clarity for me. I have a harder time completing something with just the instructions. When I am shown how to do something, it helps me click and put this together like, okay, that makes sense. This is why they did this. . . . [VLE] was more immersive, and you could see if something didn’t look right and compare it to the teacher’s example easily.

Joe’s response revealed that the content delivery and design allowed him to feel more knowledgeable about the subject.
Participants who did not connect a learning style to how the VLE impacted them as a learner still discussed the visual lectures and display of information as benefits of the VR lectures. When John described how the VLE impacted his understanding of the course material, he said he liked the teacher being able to put the problem up on a board, and you can actually follow him step-by-step; and if I’m stuck on that problem, I can pull the problem up and show him and found out what I’m missing. . . . You can share your screen in Zoom, but you don’t get the visual step-by-step like in VR.

John’s response demonstrates that the way the information was displayed in connection with the communication from the teacher allowed him to feel more confident regarding the subject. Larry further supported the impact of the visual component of the VLE. When Larry shared how the VLE impacted his understanding of the course content, he said, “You are able to like scoot up, zoom in, look at it [3D object], point it out, pull it apart and everything in a digital environment. This isn’t something that you can typically do online.” Through these reflections, it became evident that the 3D representation of the content connected with students and allowed them to gain a deeper sense of understanding, which allowed them to feel more confident with completing assignments.

In contrast, a few participants did not find that learning in the VLE impacted their understanding of the course material. When Mike discussed how the VLE impacted his learning, he said it was “kind of like Zoom, honestly; you go to the room, talk to your classmates, and have slides presented to you.” Mike did not seem to find the unique way the information was presented in the VLE to have an impact on his comprehension of the material.
When David was asked if the VLE impacted his understanding of the content being taught, he said, “I had to sit there and watch the whole time and then I forgot everything when it came time to do the assignment.” His response revealed that he struggled with connecting the material in the VLE to his weekly assignments. However, other participants spoke about interacting with the material, whereas David only watched, which appears to have impacted his understanding of the course content.

The participants who felt that the visual representation of content in the VLE was impactful said they wanted additional courses in the online program to use VR to teach abstract or more difficult concepts. When Cheryl was asked to identify other courses and material that would have been beneficial to see in the VLE, she said, “We could have used it for other programming courses, so the teacher could show us how to code in a more visual space.” Earl provided similar feedback, saying, “My only regret is that it was only ever used for the one class, and as an online student this space is as close as I’m going to get to my classmates.” Through these insights, it became evident that a majority of the participants felt that the visuals in the VLE had a positive influence on their knowledge comprehension.

**Ease of Communication**

The subordinate theme *Ease of Communication* emerged as participants shared their experiences in the VLE. Participants expressed how interactions with their teacher and peers in the VLE enhanced their desire to learn. The VLE emulated a campus lecture and seemed to have a positive impact on how the teacher was perceived because the students were able to make eye contact with the teacher and ask questions in real time. As a result, students were more invested in their learning. Earl described how the ability to see his teacher in the VLE impacted him. He said, “There’s like a living, breathing human up there. I was able to ask questions to the teacher
who was right in front of me.” Through the ease of communication, Earl felt motivated to engage with the course content. This was evident in his response when asked why “seeing” his teacher motivated him as a student. Earl said,

If you had a question, having the ability to illustrate what you mean, in real time, in a 3D space is a huge advantage over other online lectures. I asked more questions during the lecture just because it was a lot easier to bring forth questions.

When participants compared their experiences to asking questions in courses that did not use the VLE, the stories reflected feelings related to isolation and a lack of motivation to fully engage. Cheryl highlighted the difference between asking questions in Zoom and the VLE. She said, “In Zoom, teachers forget who asked what, you have to hope they remember who had a question next, while other students are still chatting in the chat box, and your questions get buried.” Her response seemed to reflect the traditional feelings of isolation that are common among online students. Cheryl said the following talking about her experience in the VLE,

It was nice to not feel like you were just looking at a flat screen of your teachers. He [the teacher] talks and notices when you have a comment. People can raise their hands and interact in a physical way that made people take notice.

Cheryl’s response revealed that being seen through physical movements or the raising of the hand made her feel noticed and encouraged her to take an active role in her learning.

Larry echoed Cheryl’s experience when asked how his teacher’s acknowledgement played a role in his motivation towards the learning material. He said,

The teacher would regularly acknowledge when they answered someone’s questions and wouldn’t move on until after he asked if anyone else had follow-up questions. I think [VLE] helps drop that inhibition curtain since you aren’t just a name if you ask a
question and you have a more in-depth interaction and that helps pull the curtain up and you are more than likely able to ask more questions.

Through the eye-contact capabilities in the VLE, Larry felt seen and also was impacted by watching his peers getting noticed. Larry highlighted the difference between the presence of his teacher in the VLE compared to Zoom in saying, “The message in Zoom is going 900 miles an hour, and your question can get passed up.” His perceived lack of response from the teacher in a traditional online environment highlights how students can feel disconnected in the online space. The ability of the teacher to make eye contact in the VLE also impacted Joe in a positive way. When Joe shared how the VLE impacted his feelings of presence towards his teacher, he said,

It felt like [the teacher] was there. You can interact more in there [VLE], and during discussions other people might ask questions that spark questions you didn’t know you had, and having the teacher there made it less intimidating to ask questions. In Zoom you are just sitting there waiting to get called on.”

It became apparent that the enhanced sense of presence of his classmates and teacher made Joe feel more comfortable asking questions about the material. His natural comparison to Zoom demonstrates a barrier between the student and the teacher.

The ease of communication and perceived closeness to the teacher in the VLE seemed to enhance the presence of the teacher and decrease the physical space between the learner and the teacher. The feelings of enhanced presence seemed to impact Cheryl’s feelings related to motivation. The attention the teacher gave Cheryl in the VLE appeared to make her feel that she mattered. She said, “When the teacher made eye contact, it felt like he was invested in us and that motivated me and gave me a stronger connection with the teacher.” Similarly, Suzie expressed
the positive impact the VLE had on her engagement in the course when asked how her teacher’s eye contact played a role in her learning experience. This was evident when she was asked how her teacher’s presence played a role in her learning experience. She said, “I asked more questions because you could get an answer right away, compared to having to send a message in the platform, or hope your question doesn’t get lost in a chat box.” After each VR session, Suzie expressed the impact it had on her motivation to complete her work. She stated, “I felt like it [VLE] helped me a bit more on the assignment because I would start my assignments after the session and it felt like it stuck in my brain more.”

An element of a VLE is that students feel that they are seen and heard in a space that is similar to what they experience in a classroom.

Enhanced Concentration

The subordinate theme Enhanced Concentration emerged as participants discussed their experience in the VLE. During interviews, students often compared the time spent learning in the VLE to other online lectures, and participants generally felt that they were able to concentrate better in the VLE because of the VR headset, which minimized distractions from the outside world. The engaging environment of the VLE was also frequently cited as a positive influence on participants’ ability to learn. When Shawn discussed how the VR enhanced his ability to focus, he said, “I was paying attention to everything in the virtual world and wasn’t distracted by my TV or background noises in [the] house.” Shawn compared this experience to his concentration during lectures that took place outside the VLE; he found that “the Internet, his animals, and TV pulled my focus away from the teacher, causing me to miss important information or having to watch a recording of the lecture later.” Enhanced concentration through the use of the VR headset seemed to mirror the experience of being in a physical classroom. Shawn’s response
revealed that he was aware he was distracted in traditional online lectures; however, the VR headset helped him focus on the task at hand.

Conversely, Mike attributed his enhanced concentration to the engaging environment of the VLE. He said, “The VR headset played a role in helping me actively pay attention, but the interaction in the VLE was the reason to pay attention.” Mike perceived the interactions within the VLE as the primary reason he was able to focus. This was made further apparent by his response when asked how he interacted in the VLE compared to other online sessions. He said, “In my other online lectures, I could pull up a window and watch YouTube or whatever, so in the VLE I was forced to pay attention.” Larry also recognized that he was more focused during the VR lectures. When Larry compared how his experience in the VLE was different from attending other online lectures, he said, “I usually surf the Internet while the teacher is talking. In the VR lecture I asked questions, chatted with classmates, and used tools to draw.” Larry’s response seemed to reflect how the engaging VLE environment blocked outside distractions, so he could focus on learning in the VLE.

Similar to Larry, when John was asked how the VLE compared to his other online lectures, he said, “I would get lost in time in the VLE because I was focused on enjoying learning, asking questions, and getting to interact with classmates.” In traditional online lectures, John felt that he took a passive role as a student and did not interact at the same level he did in the VLE. This was reflected in his response when asked how he felt in online lectures. He said, “I’m always asking myself, ‘Is it over yet?’” Suzie also credited her increased concentration to the VLE. When she shared how the VLE impacted her learning, she said,
I felt like there was less distractions in the VR lectures. I was there. I couldn’t see anything in my peripheral vision that could distract me. I was able to focus more since I was able to see what he was doing when he was teaching.

Suzie’s response seemed to indicate that the VLE made it easy for her to focus through the sense of being physically present. Mike also indicated that the VLE positively impacted his learning by helping him actively pay attention. He said, “You have a headset on and you’re like actively paying attention and stuff, instead of like going to a normal class when we just go, show up, and stare at the teacher.” These responses demonstrated that the participants attributed their enhanced concentration to the engaging learning environment within the VLE. This was partly due to the need to wear a headset that blocked outside distractions and led to a sense that their teacher was interacting with them “in-person.”

**Summary**

Enhanced student learning in the VLE was evident in participants’ description of their experiences using VR in an online course. Interactive lectures, 3D models, and drawing tools resonated with a variety of learning styles and helped the students learn the course material. The tools in the VLE that were utilized for written and verbal communication established a more engaging space to learn and seemed to act as a bridge to bring online learning closer to traditional learning that occurs in a physical classroom. As a result, students were focused and engaged in ways that are not typical in online lectures.

**Presence of a Learning Community**

The second superordinate theme to emerge was *Presence of a Learning Community.* Participants described how they felt as if they were physically present in a classroom in the VLE, which helped to establish a learning community with their peers. They indicated that the VLE
promoted engagement with their peers and teachers in a way that traditional online courses cannot. Two subordinate themes were captured in participants’ accounts of their experiences with the VLE, Classroom-Like Environment and Deeper Connections with Classmates and Instructor.

**Classroom-Like Environment**

In this subordinate theme, as the participants reflected on why they were more interactive in the VLE, it became evident that the virtual space closely mirrored the experience of being in a physical classroom. When Shawn was asked why he felt more inclined to interact in the VLE, he said,

A few of my classmates and I would go into the VLE just to hang out. We would make a room, and challenge each other with various questions or, uh, mathematics. And you can’t really do that in other online lectures. It felt like a real lecture.

Through the tools in the VLE, Shawn was able to meet with his peers outside of the VLE lecture, which mirrored similar opportunities available to on-campus students.

Suzie elaborated on why she enjoyed her time in the VLE more than in other online lectures. She said,

[VLE] is just more involved so you’re into it more than you are from a Zoom lecture because you’re kind of there, you can talk to your peers easier. It felt like a classroom, like a lecture hall setting, and you are sitting next to your classmates and you could just talk to them easier.

Suzie seemed to connect the way she was able to interact and attend the lecture in the VLE as similar to behaviors she would exhibit in a real classroom. Similar to Suzie’s experience, John credited the campus atmosphere in the VLE to the interactions he had with his peers. When he
described what he meant by “atmosphere,” he said, “It reminded me of a lecture hall where you just pick a seat, raise your hand if you have questions, or just speak up if you need assistance.” John found the VLE to be similar to a classroom, saying,

I just put my hand in the air when I had a question and that concept is more realistic than pressing an icon that raised a hand for you. . . . it was the first time I felt like I was in a classroom since being an online student.

When asked how this impacted his experience as an online student, he said, “I felt more connected to the other students and my teacher. You could see their mannerisms and just the way they move their hands and body when they talk.” Joe seemed to appreciate the ability to observe his peers’ physical movements and aligned this with what he experienced in a physical classroom.

Larry expressed similar feelings when he reflected on why he interacted more with his peers in the VLE. He said the VLE “was not only like a classroom, but an environment where you can talk, give a presentation; it just opens up the possibilities. . . . This is what online learning should be like.” The capabilities of the VLE were perceived to extend beyond a virtual interaction and mirror a physical classroom space, which seemed to motivate Larry to learn alongside his peers. This was evident when he said,

With VR, you can see the person asking the question; you can build something with classmates like if you were in a classroom together; and this is different than, you know, just watching somebody do something or explain something like in other lectures [non-VLE].

These responses demonstrated that the tools and capabilities of the VLE simulated the same behaviors that students had experienced when attending an in-person class.
Deeper Connections with Classmates and Instructor

The subordinate theme Deeper Connections with Classmates and Instructor emerged as participants shared their experiences in the VLE. As participants recalled their time in the VLE, they seemed to appreciate the opportunity to interact with their classmates and the instructor in a tangible way. At the start of the course, students chose their own avatars and had the option to personalize them. Interactions between students and the instructor were achieved through the avatar, which could move around the VLE based upon the controller movement.

Through the participants’ responses, it became clear that interactions with classmates and the instructor led to deeper connections and a sense of belonging to a learning community. Cheryl enjoyed the time she spent in the VLE chatting with her classmates and teachers. When asked to describe her time in the VLE and how it impacted her learning experience, Cheryl spoke frequently about her interactions with her peers and teacher and the ability to easily connect. She said,

You could come in a little bit early, before the class and just be with them [classmates and teachers]. You could also hang out after the lecture and go over stuff with him [the teacher]. . . . Everyone projected excitement and a desire to learn and engage that created a positive atmosphere.

Cheryl’s response reflected her appreciation for being able to directly interact with her classmates in the VLE. When asked why she did not interact with her peers and teachers in other online lectures, she said, “Lectures not done in the VLE weren’t the same because you are watching a video and there is just a disconnect between the teachers and us because it’s just a screen.” Her comparison between the VLE and the traditional online lectures seemed to indicate that she perceived that learning through video did not foster interaction with the other learners.
and did not bring the learners together to create a community. Joe’s responses echoed Cheryl’s. When Joe was asked how his interactions in the VLE affected his experience, he said,

It was nice to actually see them [peers and teacher], that someone’s talking to you, not just a voice or text again. . . . You feel more connected to other students and the instructor. It’s more like you’re getting a visual representation of them, you know. You can see their mannerisms and the way they move their hands. You can understand them better because you can see them.

Joe’s response suggests that these interactions were a positive influence on his sense of connection to a community of learners. Larry emphasized that he also found the VLE interactions to have a positive impact on his experience, as well as his interactions with peers. He said,

[Interacting] is fun in VR because you’re bonding on a different level than what you’re actually there for. You are still learning, but you’re also, you know, interacting and learning with your peers.

When describing how learning with his peers influenced his connection to the online learning community, he said, “It motivated me, and that made me want more opportunities to reach out, ask questions, and be a part of the class.” Larry’s response suggests that his interactions in the VLE pushed him to connect outside of the class, which played a role in the creation of an online learning community. David provided a similar response to Larry when asked how interacting with his peers and teachers impacted his experience in the VLE. He said, “I felt like I wasn’t alone. . . . You actually get to the see the people and interact with them; you’re like, okay, this is the reason why I’m working.” David’s experience reveals an ability to connect with his peers
over a common interest. Later in the interview, David attributed his enhanced interactions with his classmates to the avatar, saying,

    I like to see who it is that I’m in class with, you know, see their face and see who they are, you know. You know, with the Ready Player One type of avatars, you don’t really know who it is, but it’s still kind of cool that you’ve got characters there.

It became evident that the avatars played a role in David’s feeling of being connected to his classmates and that it did not matter what they looked like as long as his peers were virtually represented.

    The ability for the participants to interact with peers played an important role in their sense of community. When Earl was asked how interacting in the VLE played a role in his experience, he went beyond conversation and spoke about physical moments. Earl said,

    You’re actually talking to someone in front of you. There’s more than just their voice. There’s the way they move and all the different mannerisms and that’s a big part of connecting. . . . After being an online student where it’s just you with a single schedule and contacting the teacher through direct messages or emails the entire time, being able to go into a VLE is like 100% online students’ way of seeing each other. It was like “Oh, hey, there are the other people that I have been passively working with and the instructors that I’ve been talking to on a weekly or daily basis.”

Earl’s response revealed the heightened sense of presence he felt from his peers’ physical movements combined with the interactions that allowed him to feel part of a community.

Similarly, when Mike was asked how he felt about the role of the avatars in the VLE, he said,

    “You get to see people’s creative sides and what they want their digital persona to be. It made it
more personable.” The avatar seemed to help Mike make deeper connections with his classmates when they personalized the avatar.

The participants’ experiences in the VLE suggested that the ease of interacting though physical movements via the avatar fostered a deeper connection among the learners. It became evident that the VLE allowed the students to interact and engage in ways that are associated with classroom behaviors found in a physical classroom.

**Summary**

Participants discussed how the VLE made them feel that they were in a physical classroom instead of an online course. This sense of being in a physical classroom resulted in increased interactions with their classmates and a sense of belonging to a learning community. The next superordinate theme surfaced when participants shared how the VR software and tools impacted their experience.

**Technology**

The third superordinate theme to emerge was *Technology*. Participants’ use of the VR technology, while primarily beneficial, was not without its limitations. As participants discussed how the VR technology facilitated interactions with peers and faculty and how they felt connected to the physical classroom environment, they also experienced cybersickness in the VLE. In addition, the participants touched on the limitations of the graphics in the VLE and how there was a lack of seamless transition. Within this superordinate theme, two subordinate themes emerged.

*Cybersickness*

The subordinate theme *Cybersickness* emerged as participants shared their experiences in the VLE. VR can be a powerful tool for learning and enhancing feelings of presence in the VLE;
however, it can create more psychological space between the users and the learning community due to feelings of cybersickness. When Suzie was asked if she had any other thoughts or stories she wanted to share regarding her experience using VR, she said, “I had to sit there for a moment [after the VLE] because it gives me a headache.” It appeared that she enjoyed her time in the VLE; however, the impact on her after the lecture was debilitating until she reoriented herself. Similarly, David expressed how the VLE caused him to feel sick. This was evident when he was asked about his challenges using VR, and he said, “VR made me feel dizzy if I used it for an extended period of time.” His response revealed that he did not want to be in the VLE for longer than needed and that the time in the space should be focused to avoid extended time in the VLE.

Mike discussed the length of time in the VLE and its impact on cybersickness when he was asked what he did not like about the VLE. He said, “I have to be very careful with time and making sure that I don’t overdo it or anything.” He said he had to take breaks and remove the headset for a short period of time, causing him to feel that he was missing out on learning and connecting with his peers. This was evident in his response when he was asked how taking breaks impacted his experience. He replied, “Not being able to participate all the time because I get sick. It sucks. I can’t. I can’t. I have to be careful.”

When Joe was asked if he had any challenges he wanted to share about his experience using VR for learning, he said the VLE “was disorienting at the start, and the first few times, umm, it was an adjustment. I wear glasses, so I kept having to adjust the headset.” It seemed Joe felt disconnected from his peers and the content when he was adjusting to the VLE and trying to make sure the headset fit properly to accommodate his glasses.
Lack of Seamless Transition

The subordinate theme *Lack of Seamless Transition* emerged as participants shared their experiences in the VLE. Other limitations of the VR technology were captured in the lack of a seamless transition to the VLE due to poor graphics, inconsistent access, and inability to take notes. When Larry was asked if the visuals of the VLE impacted his experience, he said,

It didn’t look amazing [commenting on aesthetics]; it was a bit choppy. The graphics could definitely be better, just to create an environment to do something. It’s different, you know, but it is going to be better eventually.

His response revealed an understanding of the capabilities based on technology; however, it was evident he hoped for a more seamless transition between the real-life environment and the VLE.

John also had trouble consistently accessing the VLE. When he was asked how it impacted him, he said, “I felt left out when I missed the first part of the virtual lecture due to my technology issues.” His response revealed that he struggled to engage with others when he was not able to access the VLE. Shawn also experienced technical issues and was not able to get support. When asked how this impacted his learning experience, he said, “I was alone and couldn’t get help, and it was frustrating.” As a result, he ended up not returning to the class lecture. It was apparent that the lack of immediate technical support made it challenging for him to transition from the traditional learning environment to the VLE, which made him feel isolated and caused him to disconnect.

Some participants did not have any technical issues with the VR; however, they had issues with the technology capabilities once inside the VLE. When Earl was asked if he had any additional insights to share with the researcher, he said,
The worst thing was the inability to take effective notes while you are in there. Obviously, you don’t have a pen and paper that you can easily access, so you had to have one of the controllers on the floor, which means your hand is like a good three meters away from you at this point, which looks weird, all to actually take notes.

It was evident that the inability for Earl to take notes in the VLE impacted his learning experience. Mike shared similar challenges as Earl when he was asked what he did not like about using VR. He said, “I don’t really like the controls; it made me feel disconnected and like I had no control.” His perceived lack of control in the space made him feel disconnected from being able to easily learn.

The technology challenges shared by the participants did have a direct impact on their ability to learn in the VLE and communicate with their peers and teacher.

Summary

The participants discussed various challenges and desires for the future of VR in a learning environment. At the same time, they understood that as technology advances, the VLE and technology tools improve, which will result in a more sophisticated immersion for the user. While participants cited positive feelings about the VLE, some of them struggled with cybersickness and issues with seeing if they wore glasses. The technology challenges highlighted were not all experienced the same way by each user. As a result, enhancing the VLE technology or the VR headset might only eliminate a challenge for one user and not all.

Conclusion

The purpose of this qualitative study was to explore the lived experiences of online students who used VR in an online course. The research focused on gaining in-depth descriptions from each participant. The researcher engaged in the meaning-making process of the lived
experiences through thematic and narrative analyses. The collected data revealed that online students who used VR for learning felt the VLE had a positive impact on their comprehension of the course material. The tools in the VLE were easy to use and allowed classmates to interact and socialize in a way that was similar to on-campus student behaviors. The VR headset became a barrier between the online learners’ noisy environment and learning, which enhanced the students’ ability to concentrate. In combination with the feelings of enhanced learning and the presence of a learning community, students also felt a sense of learner autonomy through the experience in the VLE. Emerging technology such as VR has shown an ability to connect; however, there are limitations to the tool due to the varying levels of technology access and the physiological challenges of each individual user. Nevertheless, online students are hungry for the use of emerging technology in online learning to mitigate challenges associated with the psychological space that is created between the student, teacher, and classmates.

Chapter 5 will connect these research findings to the theory of transactional distance. The connections drawn between the findings and theory will support Moore’s (1997) open-ended analysis to study psychological space for online students. Each of the participants in this study had a personal experience in the VLE that differed from others’, which highlights the need for a theory that honors individuals and their lived experience.

The majority of studies of VR and learning have been conducted in the campus environment. The literature for this research synthesized multiple studies connected to online learning behaviors, VR research completed on campus, and faculty behaviors in online learning.

In Chapter 5, the researcher will extend the literature to address how current studies focused on learning with emerging technology connect to similar behaviors found in the campus environment when studying VR.
Implementing VR in education has achieved positive results connected to decreasing the psychological space for the online student. Leaders, administration, and faculty in education have the ability to impact the online learning space using emerging technology. Chapter 5 will address recommendations for practice and a step-by-step process to implement VR in online degree programs in a way that is done with intention and rigor to help extend research in the subject of online learning and VR.
Chapter 5: Discussion and Implications

The purpose of this research was to explore the connection between virtual reality (VR) and transactional distance on student learning in distance education through a qualitative interpretative phenomenological analysis (IPA). Transactional distance theory was the theoretical framework used to understand the lived experiences of online students who used VR in an online class. The researcher addressed the following questions:

What are the experiences of online students enrolled in a Bachelor of Science degree program who utilized virtual reality?

Sub-Question: How does virtual reality impact online students’ connections to the structure of the academic course?

Sub-Question: How does virtual reality impact online students’ feelings of autonomy?

Sub-Question: How does virtual reality impact online students’ interactions with both peers and teachers?

This chapter will review the problem of practice and the themes identified during the data analysis. The research findings will highlight a connection between the literature review and the theoretical framework. In addition, the researcher will provide recommendations for practice and for future research before discussing the limitations of the study. The chapter will conclude with a summary of the larger impact of this study in relation to online learning.

Summary of Study: Problem of Practice

Online enrollment is expected to increase as technology allows the online environment to mirror the campus space. Private companies continue to move funds into the education sector to revolutionize the learning environment (Bellini et al., 2016; Gay & Betts, 2020). Educators seek innovative ways to update curricula and teaching methods to fit the needs of the 21st-century
learner. While VR dates back to 1957, the connection to how the tool is used in a learning capacity for distance education has not been thoroughly researched (McFaul & FitzGerald, 2019). Researchers have examined the relationship between online learning and components related to gamification techniques to show how a learning environment that is interactive and personal to a student enhances the connection between the content and the student (Davis et al., 2018; Ludlow, 2015).

Online students have a distinct set of technology characteristics that they bring to the learning management system (LMS). Each online student has an individual Internet connection and device to connect to the provided LMS, as well as a personal technology comfort level. The multiple variables brought to an online class from each online learner have created a unique challenge for educational institutions to implement emerging technology such as VR and augmented reality (AR) in online education. In addition, the varying levels of technology access that online students have, as well as learners’ personal attributes such as visual and psychological needs, provide another layer of complexity. To mitigate some of the technology challenges of online students, many institutions have implemented one-to-one programs in an effort to establish a baseline among online learners and technology access. At the university where this research study was conducted, all online students have the same laptop and software, which allows educators to design curricula with an understanding that all students have the needed tools to successfully complete each course.

Connections to Theory

The theoretical framework that was employed as a lens in this study was transactional distance theory (TDT). TDT was developed by Michael Moore (1997) to study distance education and the impact of student-to-student, teacher-to-student, and student-to-contact
relationships through dialogue, course structure, and student autonomy. TDT encompasses student behaviors associated with learning online and serves as a guide for researchers on how to enhance the online learning environment through the lived experiences of online students (Falloon, 2011). The themes identified in Chapter 4 directly relate to Moore’s research demonstrating the importance of three components—dialogue, structure, and autonomy—in learning.

**Table 3**

*Connecting Themes and Participant Responses to Transactional Distance Theory*

<table>
<thead>
<tr>
<th>Superordinate theme</th>
<th>Transactional distance connection</th>
<th>Participant comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enhanced Student Learning</td>
<td>Structure/Autonomy</td>
<td>“I was excited. It can be a bridge for people that are visual learners. It will give them [online students] more control, and I love that.”</td>
</tr>
<tr>
<td>Presence of a Learning Community</td>
<td>Dialogue/Autonomy</td>
<td>“I asked more questions because you could get an answer right away, compared to having to send a message in the platform, or hope your question doesn’t get lost in a chat box. I felt like it [the virtual learning environment] helped me a bit more on the assignment because I would start my assignments after the session, and it felt like it stuck in my brain more.”</td>
</tr>
<tr>
<td>Technology</td>
<td>Structure/Autonomy</td>
<td>“The virtual learning environment reminded me of a lecture hall where you just pick a seat, raise your hand if you have questions, or just speak up if you need assistance.”</td>
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</table>
The first theme, *Enhanced Student Learning*, aligned with the structure component of TDT. Structure is defined as “the level of course rigidity and flexibility” (Moore, 1997). According to Moore, students should be able to navigate the online learning environment easily to feel supported, guided, and empowered to learn. Gaining access to course materials, sending messages, and inhabiting spaces that allow for interaction are variables associated with the structure of an online course.

The findings of this study aligned with TDT in that the structure of the virtual learning environment (VLE) allowed students to navigate the course with ease. Participants were able to download the VR software without any complications and to gain access to the VLE using step-by-step instructions provided by the teacher and the university. If students had any technical complications or questions, they had access to an in-house technical support team who were aware of the software and tools being used to provide proper support. The VLE put the students front and center of the learning by using 3D models and slides to communicate information. Students reported that the way information was provided to them spoke directly to their self-identified learning style. Moore’s (1997) definition of structure in the online space is enhanced when students are in a VLE and have direct access to their teacher and tools that personalize the space, while also making students feel as if they are in closer physical proximity to the learning environment.

Moore’s (1997) TDT postulates that when course structure drops below an unidentified threshold, the distance for the learner can increase. The lack of threshold related to structure was originally created for online learning; however, a VLE provides a campus-like learning experience. As a result, having a more refined definition of structure in the theory would further
research on online learning environments that use immersive technology to decrease the transactional distance for the student.

The second theme, *Presence of a Learning Community*, supported the dialogue component of the TDT framework. Dialogue is defined as interactions that take place between the learner and teacher, internally and externally (Moore, 1997). The course materials, assignment feedback, and discussion boards are tools that increase dialogue in an online course. According to Moore, dialogue includes the internal interaction that takes place when an online student is reviewing course materials and recorded course lectures. The teacher has to engage the learner in a dialogue by actively participating in the course. In addition, the student has to enter into a dialogue with the teacher by asking questions, reviewing course materials, and seeking feedback.

All the participants in this study described how the VLE allowed them to interact naturally with their peers and teacher by asking questions, drawing together, or making direct eye contact with one another when seeking insight or trying to gain clarity on a particular subject. The VLE was distinctive in that students were able to physically raise their hands to get the teacher’s attention, which is not possible in a traditional online course environment. In addition to allowing for physical movement, the environment used directional sound to simulate physical proximity. The ability for the participants to hear their teacher or classmates from the direction or closeness of the avatar encouraged participants to interact with each other in the VLE. The VLE also allowed students to receive immediate feedback from the teacher when participating in activities, which elevated the students’ dialogue in ways that are not possible in traditional online learning environments. Further, most of the participants reported that the
immersive lecture experience allowed them to understand the course content on a deeper level and enhanced their ability to complete assignments with fewer questions.

The interactions that took place in the VLE were extremely different from the traditional interactions studied in the TDT framework. To date, research using TDT has not involved VR and the capabilities of the VLE that imitate on-campus student learning behaviors. Dialogue, another TDT component, provided a strong framework to understand the distinctive learning behaviors and communication aspects that took place in the VLE.

The third theme, Technology, aligned with the autonomy component of the TDT framework. Autonomy is established by providing an online course that supports a variety of student behaviors and communication tools (Moore, 1997). A course that has a flexible structure, includes detailed instructions, and offers multiple ways for dialogue creates a learning environment that speaks directly to the needs of all learners. Autonomy is established when the teacher designs a course that allows students to easily communicate and gain access to course materials. In the TDT, these variables play an essential role in helping students feel empowered and confident to complete their assignments without a teacher being near them as they would have if they were attending on-campus courses.

The findings of this study indicate that the VLE enhanced all of the online tools students use in online learning; these included video lectures, discussion board, messaging, and assignment feedback. Participants regularly compared other conferencing tools to the VLE and discussed the difference and the impact the VLE had on their learning and understanding of the material. Students reported that having the ability to see images in 3D allowed them to better understand the course material. Many of the participants found that they had fewer questions on assignments after attending a VLE because of the engaged class lecture. The VLE made students
feel as if they were sitting in a live classroom and had access to a teacher who could answer questions. The environment motivated students to engage and network in formal and informal ways. Participants were able to spend time in the space drawing, talking, or attending a question-and-answer session with the teacher. Finally, the students had fewer distractions, which also played a role in their enhanced concentration to have the ability to be more autonomous.

The immersive structure of the VLE, in combination with campus-like communication behaviors, enhanced the level of autonomy examined through the TDT lens. An online learning course that provides robust learning activities and allows students to engage with each other synchronously or asynchronously creates an environment that fosters deeper learning. The autonomy component of the TDT is broad enough that it allows for the multitude of ways each online student might experience autonomy and the impact it has on the individual student in connection to learning.

**Summary**

TDT is a leading framework for studying the online learning environment. Other online learning frameworks such as Communities of Inquiry (Garrison et al., 1999) and Relative Proximity Theory (Swart et al., 2014) have also played an important role in helping educators understand the online learning environment. Since the fourth educational revolution, online learning has grown and evolved to bring more interactive learning components to the online student to decrease the psychological distance (Cooper et al., 2019). However, until VR and the creation of a VLE, online students never experienced feeling that they were in a learning space that is similar to a face-to-face environment. As emerging technology continues to enhance the online learning environment, theoretical frameworks will help to expand our understanding of
how to create a connected VLE and identify the variables that will make for the best learning environment.

**Connections to the Literature**

Many educators, administrators, and policy makers have discredited online learning. However, emerging technology has the capability to enhance online pedagogical frameworks to emulate similar collaboration and learning activities as a campus environment (Villarruel et al., 2019; Robinson et al., 2017; John, 2015). Learning in the online classroom can be as effective as face-to-face learning when using emerging technology to enhance collaboration, feedback, and a sense of community (Robinson et al., 2017; Hs & Shin 2013). As a result, it can be argued that online learning can provide meaningful learning opportunities that have the potential to change education.

The findings of this qualitative study highlighted the impact of VR in online learning as perceived by students who used VR in an online course. In the VLE, students perceived an enhancement in their learning and communication, and the technology enhanced the online learning environment. The findings from the lived experiences of online students who used VR in an online course aligned with the current literature on the ability of emerging technology to enhance learning. However, to date, little research has been conducted on the impact of VR in online learning as perceived by students. The findings of this study support recent research on distance education, VR and VLEs, and instructional design methods for teaching. In addition, this study extends the current research in distance education through emerging technology.

**Theme 1: Enhanced Student Learning**

The superordinate theme *Enhanced Student Learning* encompassed three subordinate themes: *Alignment with Learning Styles, Ease of Communication, and Enhanced Concentration.*
Through participants’ accounts, it became clear that many self-identified as visual leaners, which was well suited for the VLE. The participants also discussed how the VLE made communication with peers and the teacher easier. The participants reported having the ability to make eye contact with the teacher, raise their hand and ask questions, and show their work in real time as reasons they felt the VLE enhanced communication. In addition, participants described an increase in concentration because the VR headset immersed them in the learning environment. These findings suggest a solution to the online retention challenges discussed by Gay and Betts (2020) and Phirangee (2016).

The findings of this study support the use of VR in online environments, as the participants reported a better understanding of the course content after learning in the VLE. These findings align with other studies on VR and visual learning. Cutting-edge technology has demonstrated positive results in learners’ retention of information when interactive teaching strategies are implemented in a purposeful manner (Billingsley et al., 2019; Wynants & Dennis, 2018). According to Billingsley et al. (2019), online environments that have used VR to provide training to teachers demonstrated an increase in learning outcomes on complex topics related to STEM subjects. Similarly, Patwardhan and Murthy (2015) conducted a quantitative study on the visualization of learning in distance education. The authors found that stronger visualization, partnered with interactivity, led to a deeper understanding of procedural knowledge. Similarly, the current study found that the online participants thought the visual display in the VLE and the ability to interact easily helped them understand the course content in a way they had not experienced in other online courses.

While the research conducted for this study did not directly measure learning outcomes associated with the VR lectures, the participants did report a better understanding of the course
content as a result of the VLE. In addition, the participants had fewer questions and felt more confident to complete their weekly assignments than they had in courses that did not use a VLE. Learning environments that provide high visualization for examples and demonstrations are regularly associated with enhanced cognitive presence (Guney, 2019; Wynants & Dennis, 2018). One of the benefits of the VLE used in this study was the participants’ ability to watch their teacher perform certain exercises and then complete the exercises themselves in a 3D space while receiving live feedback from peers and the teacher. These findings support research conducted by Huang and Liaw (2018), Yang et al. (2018), Zizza et al. (2017), and Madden et al. (2020) that demonstrated the positive impact of VR and VLEs to bring the student closer to the teacher and course content.

Prior research has found that peer–teacher and peer–peer interactions are directly connected to enhanced motivation and engagement in online courses (Bollinger & Halupa, 2018; Heron & Casarez, 2017; Kassandrinou et al., 2014). In addition, creating an online environment that allows students to interact enhances the learners’ connection to the learning process and is associated with higher levels of course satisfaction (Gutierrez-Santiuste & Gallego-Arrufat, 2016; Kilbanov et al., 2018). Those findings were reinforced in the current study through participants’ accounts of the desire to communicate with their peers and teacher. The participants credited the VLE for providing adequate communication tools to allow for easily accessible conversations with peers and the instructor. For example, many of the participants discussed staying after class to ask questions and show work to the teacher. The participants also reported that having the ability to raise their hand for help and speak directly with the teacher were reasons why the communication in the VLE was more fruitful and immersive than in other course formats.
The participants in the VLE found that the space naturally provided them the environment needed to stay focused. Online environments that provide rich learning opportunities enhance academic success for online learners (Soffer & Cohen, 2018; Sumuer, 2018). The rich learning environment offered in a VLE plays an important role in engaging online learners and helping them stay focused and motivated. Participants in the current study reported feeling less distracted than usual when they were in the VLE due to the headset and engaging learning environment, which motivated them to immerse themselves in the VLE. Students also reported that, when inside the VLE, they did not have the ability to search the Internet or otherwise disengage from the lectures. When participants compared their behaviors in the VLE to online lectures without VR, they regularly reported tuning out the lecture and searching the Internet. As a result, they would have to review recorded lectures at a time when they could not interact with their peers and teacher. The disconnect from outside interactions plays a role in the development of a learning community, which is an important part of the online learning experience (Despres-Bedward et al., 2018; Epp et al., 2017; Gay & Betts, 2020).

Theme 2: Presence of a Learning Community

The superordinate theme Presence of a Learning Community encompassed two subordinate themes: Classroom-Like Behavior and Deeper Connections with Classmates and Instructor. The participants reported that the interactions that took place in the VLE closely mirrored the experience of being in a physical classroom. The tools available in the VLE also allowed students to interact and engage with the course materials in a way that was unique to the VLE and similar to student behaviors exhibited in a campus classroom. Through the interaction in the VLE and the tools available for communication and engagement, the participants stated that they were able to interact in a way that was tangible. Participants frequently highlighted the
ability to get to the VLE early to ask the teacher questions, draw with classmates, and interact during the lectures. The participants’ stories revealed how these personal interactions made them feel more connected to each other, the teacher, and the curriculum.

This study highlighted the positive impact VR had in the development of a learning community. Participants frequently identified with the physical behaviors of their peers and themselves that they could see in the VLE; that is not common in other online learning spaces. Students’ opportunity to raise their hand, walk over to their peers, make eye contact, and hear directional sound created an immersive space that modeled traditional behaviors found in a campus course. Students who feel that they are part of a learning community are more comfortable asking questions and engaging with the content, and they feel less isolated (Epp et al., 2017; Rovai, 2002). The development of a learning community is the responsibility of the teacher and the students in the course (Ouyang & Scharber, 2017). A learning community is established when online students have multiple ways to connect and engage with the content and when there is a sense of teacher and student presence (Gutierrez-Santiuste & Gallego-Arrufat, 2016; Ouyang & Scharber, 2017). The idea of presence in the online environment is developed when the student experiences that the teacher, peers, and learning are real (Swan et al., 2008). The immersive aspect of VR creates a learning environment that naturally fosters a sense of connection among online learners and enhances the feelings of presence (Yang et al., 2018; Zizza et al., 2017).

Avatars were often discussed by this study’s participants as a critical element of the VLE, as the physical representation of each student’s avatar contributed to the feeling of being immersed in the classroom and enhanced their presence in the online environment. The participants also reported that the movements of the avatar, such as eye contact, raising one’s
hand, and being able to move closer to students or up to the teacher at the front of the room, were important to feeling enhanced presence with the teacher and other learners. This finding is in alignment with Economou et al.’s (2017) research, which found that the use of avatars in VLEs increased a sense of community among students. Online students in that study who were able to control their avatar and have a 3D physical representation of themselves in the VLE had a positive influence on learning outcomes.

Participants in the current study also responded positively to being able to see classmates via their avatar and easily interact, which is connected to enhanced presence and engagement. Prior researchers have similarly reported how gamification techniques create an interactive learning environment and enhance the connection between the content and the student (Davis et al., 2018; Ludlow, 2015). In the current study, participants often described feeling “seen” when they were able to draw with classmates and problem-solve together. The findings highlighted that online students were willing to interact and develop meaningful relationships, similar to when they are on campus; however, the environment has to be conducive to engagement. The participants who self-identified as shy leveraged the tools in the VLE to approach students and ask questions. As a result, the participants ended up interacting in ways they had not experienced in other online courses. Many of the participants in this study shared stories related to feeling more motivated and engaged in the learning after attending a lecture in a VLE. The findings from this study support previous research that highlights the importance of student interaction in the development of a learning community.

Traditional online conferencing tools do not provide an engaging environment that allows students to naturally connect. Online learning is usually 2D, and students are aware of the
physical distance between each user. In the VLE, students were not separated because their avatars were seemingly “close,” and the software enhanced the feelings of immersion.

**Theme 3: Technology**

The superordinate theme *Technology* encompassed two subordinate themes: *Cybersickness* and *Lack of Seamless Transition*. Through participants’ accounts, it was evident that feelings of dizziness and headaches created frustrations and feelings of separation from the online course. In addition, the participants described how the technology seemed to be slow and was not as aesthetically pleasing as other environments that use VR. Participants also mentioned the challenge of wearing a headset while also trying to take class notes or move around the room.

This study identified the challenges of VR in connection to online students’ varying technology agility. VR and AR are not new to the field of education (Elmqaddem, 2019). However, the advancement in technology over the years and use of the device by the media and entertainment industries have catapulted VR and AR back into the field of education (Akbulut et al., 2018; Guna et al., 2019; Makransky & Lilleholt, 2018; Merchant et al., 2014). In previous attempts to use VR and AR to enhance learning, challenges such as uneven Internet connection, cost of the device, cybersickness, and uncomfortable headsets became evident, which made for an undesirable experience for the user (Guna et al., 2019; Kilbanov et al., 2018; Lee et al., 2017; Radianti et al., 2020; Weech et al., 2020). This study supports these findings in the literature.

Participants in this study mentioned the impact of cybersickness when using VR and how it made them feel disconnected from the learning experience. A number of challenges have been reported as impacting the online user’s VR experience, including cybersickness, prescription glasses, lack of adequate space, or lack of familiarity with hand controls (Hussein & Natterdal, 2015; Patterson & Han, 2019). Conversely, studies that used a VLE in a classroom reported
similar challenges, such as not enough room to move around to experience the VLE, headsets not being charged, getting tangled in the headset cords, and issues with the controller not being comfortable (Roman and Racek, 2018; Zizza et al., 2017). The participants in the current study perceived that VR had a positive impact on them as online students. However, the variety of learning environments each student utilizes to connect to distance education courses creates a challenge to easily implementing immersive technology in online learning.

While the technology used for VR has become more enhanced, there are still user challenges related to Internet speed. Participants in this study expressed a strong desire for the VLE to be more enhanced and seamless between the real-world and VR environments. An imbalance is created for students and teachers when each user has a varying speed of Internet connection. Many online colleges are able to provide a standard for technology use through one-to-one programs; however, they cannot ensure every online student has the same Internet power to run robust technology systems (John, 2015).

The participants in the current study reported a wide range of comfort levels for using VR and downloading the necessary software to use the device. Inan et al. (2017) and Webster (2016) identified help-seeking as one of the self-regulation skills for online students to be proactive in asking for help when struggling with technology and understanding course content. In this study, there was a technical support team available for the students to call or email if they needed assistance; however, students who had issues during the class were not able to get timely feedback from the technical support team and would shut off the lecture. Phirangee (2016) and Gay and Betts (2020) reported lack of communication between teacher and student as a leading component to online students’ feeling disconnected, which can result in retention challenges. The online students in the current study had a technical support team available to help them;
however, a lack in response time from the technical assistance created a disconnect for the students. Sumuer (2018) highlighted the direct connection between a student’s prior knowledge and comfort with Web 2.0 tools and enhanced learning. In the current study, each of the participants had the same computer and hard drive power; however, the technology capabilities of each user created challenges in terms of downloading the software or gaining access to the VLE. As identified by Sumuer (2018) and the participants in this study, allowing online students the opportunity to test the immersive technology before having to use it for learning would be beneficial to the learners’ comfort levels and allow for deeper learning when attending a lecture in a VLE.

**Recommendations for Professional Practice**

According to the study participants, VR enhanced the students’ connections to the structure of the course and interactions with peers and teachers, resulting in an increased sense of autonomy. The challenges associated with participants’ experiences in the VLE were limited and did not seem to hinder their perception that VR had a positive impact on their learning in the course. The following recommendations for practice are based on the findings of this study.

*Training*

Training educators how to use VR to enhance student learning is critical for moving technology forward in academic spaces. Administrators can actively work with training departments to ensure faculty members have the ability to test emerging technology and understand the learning environment where the technology is utilized (Kumar et al., 2019; Morgado et al., 2017; Sural, 2018). Educator training practices rooted in Dewey’s (1933) work to foster a reflective teaching process will allow educators to rethink how they design and deliver content in a form that supports enhanced technology (Sural, 2018; Walshe et al., 2019).
Providing training for educators focused on how VR, AR, and mixed reality (MR) can impact learning is essential for the technology to move forward in academia (Morgado et al., 2017).

Educators care deeply about student engagement and knowledge acquisition. Immersive technology has shown a positive impact on the online learning experience (Chang et al., 2016; Zhang, 2018). However, opportunities for the educator to experience the technology first-hand remain crucial to the implementation and success of the tools (Shelton, 2018; Walshe et al., 2019). Educators are frequently asked to implement technology without a robust training process, which can result in anxiety over loss of control and lack of understanding about how to properly teach and design using the digital tool.

Immersive technologies such as VR, AR, and mixed reality (XR) are not similar to traditional digital tools that educators use to enhance teaching and learning (Sural, 2018). Immersive technology disrupts the traditional teaching environment through an augmented experience. To properly train educators on these new tools, training programs need to place the teacher inside the new environment and allow them to receive information and interact in a way they can reflect upon. Training will allow the educators to experience the technology and think about learning through a new lens. Administrators should ensure educators are equipped with first-hand experience and knowledge about VR to help them understand how to design curricula that will be best utilized in the learning space (Morgado et al., 2017).

Participants in the current study were able to attend an online class using VR due to a forward-thinking teacher whom they described as passionate about learning and technology. The teacher decided to implement VR in this online course, with the support of administration. However, the teacher struggled to grow the technology throughout the program due to technology challenges and lack of interest from other educators.
Course Design

Course design has been an important aspect of online learning for many years. Teachers receive training on the various elements of design principles and often work with instructional designers, so that courses are curated with intention and organization. The design of a VLE requires multiple experts to ensure that students are receiving active lessons that use a variety of multimedia tools to enhance knowledge acquisition (McFaul & FitzGerald, 2019). As demonstrated in this study, a VLE that does not actively engage through activities and discussion is not as beneficial to the online learner as one that does.

The development of curriculum for a VLE needs to involve subject matter experts with design knowledge focused on 3D assets, so that VLE-specific content fosters student engagement (Alfalih, 2018; Ritz & Buss, 2016). Traditionally, an instructional designer with experience in designing in a 3D environment would not be heavily involved in the design of a course; however, with VLE, this type of position will be essential to the development of robust learning assets (Economou et al., 2017; Stoerger & Krieger, 2016). The participants in the current study regularly commented on the benefit of being able to see certain assets and demonstrate work in the VLE. To ensure the VLE creates a robust learning experience, consideration of asset creation is essential to adoption from students and teachers.

Students prefer a VLE that is similar to a real-life learning environment (Madden et al., 2020; Radianti et al., 2020). Traditionally, avatars and 3D environments model a game-like space, which makes users feel comfortable while also creating a more playful space. Moving away from cartoon environments for learning is important to students’ feeling that they are in a learning space and not inside a video game. As found in the current study, students in a more cartoon-based space with a lot of environment or avatar embellishments are more likely to find
distractions. However, when a VLE is designed with the intention to model a more lifelike space, students feel that they are inside a course, motivating them to take on student-like behaviors (Yildirim et al., 2018).

**Strategic Plan for VR in Education**

In this study, the online students enjoyed the VLE; however, they wanted the VR to be utilized in more courses and in areas of conceptual content such as math and science. Administrators, educators, and instructional design teams need to work together to formulate roadmaps that slowly and methodically integrate VR into online learning. The participants in this study reported the desire to have VR in additional online courses.

The first steps in implementing VR into online learning should focus on courses in which content is difficult to understand or where students might not be engaging at a level that is similar to other courses (McFaul & FitzGerald, 2019). Once the courses are determined, finding lower level courses that are taken before the selected course should be assessed as a place to introduce VR. For example, students could be introduced to VR in an online 100-level course through low-stakes assignments that require them to download the software and hardware to use the technology, set up the account, and establish proper username and password organization. Allowing the online students to get comfortable with the VR device and accessing the VLE will help with the ease of use for the teacher.

Slowly introducing the VR headset and software to access the VLE would allow educators and online students to become comfortable in this new type of learning environment. A methodical process will support long-term use of this new type of teaching and allow administrators and teachers to study the impact to ensure students are benefiting from VR.

**Internal Research**
To date, the impact of VR in online learning has been the subject of limited research. As a result, implementation of immersive technology has been derived from studies on online student learning behaviors synthesized with research on the campus use of VR for learning. As more online learning programs implement VR as a way to teach and connect with online students, additional research studies are needed to understand how online students respond to the immersive technology. The findings from this study with participants willing to discuss their experience in the VLE identified ways that VR could be further utilized to support the connection the online learner felt with the teacher, classmates, and course content.

Before training programs are developed, faculty and administrators should work together to determine the best way to research the impact of educator training (McFaul & FitzGerald, 2019; Radianti et al., 2020). The research will highlight what to change in the training to ensure faculty feel supported and the training is having an impact in the development and implementation of VR. The same attention could be given to developing a research strategy that focuses on online students’ responses to using the VR for learning. The insights from internal research studies will allow educators to make any needed changes to the online course. The real-time research and feedback will ensure that the VR is being implemented in a way that supports the online learner and enhances the learning experience.

Conducting internal research on the implementation and use of VR will ensure that the cost imposed on the student for the VR device is justified (McFaul & FitzGerald, 2019). In addition, the real-time research will highlight any gaps in the implementation and use process that can be troubleshooted and fixed to maintain a smooth process for the online learner. The implementation of VR in online learning should be easy for the educator and the online learner. However, understanding that VR has not been implemented on a large scale in online learning
and that the user feedback loop requires further study is important to the long-term implementation of immersive technology in distance education.

**Recommendations for Future Research**

The primary objective of this research study was to explore the experiences of online students who used VR in an online course. To date, there has been limited research on how VR impacts the online student. Most of the existing research on immersive technology has been conducted with campus-based students rather than online students. The reason for this research imbalance stems from the varying environments between the campus and online students. A researcher can easily conduct a VR research study with students in a classroom. Online students have varying technical challenges that are hard to control for a study. Future research should include online students in the study of immersive technology in order to enhance the type of learning provided to the distance learner.

COVID-19 has accelerated the growth of online programs and course offerings in ways that are unprecedented (Dhawan, 2020; Kim, 2020). As a result, more academic institutions are trying to enhance student and teacher connection through technology. The desire to enhance connection between learner and teacher will require online students to purchase additional applications or tools such as a VR headset. For the academic institution, technology budgets will bear the costs to update systems to support immersive technology tools. Future research focused on immersive technology in online learning will allow school leaders to determine what technology to purchase to enrich the online student experience.

The participants in this study spoke about their learning styles in connection with how they felt in the VLE. However, it is not known how their learning styles impacted knowledge
acquisition. Future research is needed that explores the connection between learning styles and how each style impacts knowledge acquisition for online students in VR courses.

Understanding how interactions in the VLE differ from typical videoconferencing tools used in online learning would be beneficial to school administrators who oversee budgets and the purchase of online learning tools. A quantitative study on the correlation between attending a VR lecture and weekly assignment grades would provide further insight into the depth of learning taking place in the VLE. This type of insight would also provide needed support for administrators to create a long-term plan to increase the use of VR in online learning.

Faculty training and education focused on emerging technology are another important area of focus. The VR lectures are taught by the educators, which is why understanding the proper training needed for teachers would be beneficial. Frameworks like the technology acceptance model (Davis, 1989) and the technology pedagogical content knowledge model (Mishra & Koehler, 2006) are strong tools that future researchers can utilize to understand how to train educators on using emerging technology for learning.

The participants in the current study indicated that they felt more confident completing weekly assignments after attending the VR lecture. However, the study did not collect any quantitative data to establish whether there was a direct relationship between the students’ attending the VR lecture and their weekly assignment grades. This limitation highlights the need to conduct further research to understand the impact of VR and knowledge acquisition.

The immersive environment provided by VR is unique and has little crossover to other research studies on the impact of VR used for online learning. Little attention has been given to how the VR headset provides an enclosed learning environment, creating fewer distractions for online students. Similarly, online learning studies on using emerging technology have not
reported any findings or areas of study related to removing distractions in the online space. To better understand how students are able to perform using VR, consideration should be given to the enclosed environment created by the headset.

**Limitations**

This study is not without its limitations. This study was conducted at a single site, and not all participants were in the same class during the same term. The sample chosen was a homogeneous group, and within that group each participant had taken the online course that used VR within a nine-month range. The content was the same for all, but the type of question provided or the way students engaged in the course differed for each participant. The varying amount of time each participant had in the VLE created different levels of comfort and allowed some to engage in the course more than others, which also impacted the overall student experience. The online course that utilized VR had multiple class sessions offered throughout the four-week term. The online lectures were not mandatory and were offered at the same time every week. All of the participants attended a VR-based lecture; however, participants did not attend the same number of VR lectures. As a result, each participant had a distinct experience in the VR, based on fellow students’ willingness to interact and the educator who delivered the lecture. As a result of these limitations, the transferability of this study to other academic institutions is limited. Beyond the limitations, the recommendations for future research are essential to adding to the growing research focused on VR used as a tool to enhance learning.

**Conclusion**

Since the development of technology, VR is the first tool that has the ability to make online students feel that they are in the learning environment with their peers, regardless of their physical address. Education has been predicted to become one of the main industries that will be
disrupted due to emerging technology, and online enrollment continues to rise with the growth of technology in education (Dumford & Miller, 2018; Gregori et al., 2018; Shaw et al., 2016).

The results of this study showed that online students who used VR for learning believed that the VLE had a positive impact on their comprehension of the course material. The tools in the VLE were easy to use and allowed classmates to interact and socialize in a way that was similar to on-campus student behaviors. The VR headset became a barrier between the online learners’ noisy environment and their learning, which enhanced the students’ ability to concentrate. Emerging technology like VR has the ability to connect students with their classmates and instructor in ways that are unique to a VLE. This study revealed that participants’ lived experiences in the VLE were a result of the technology capabilities of VR.

As online enrollment continues to grow, teachers, administrators, and policy makers need to work together to understand how to best implement and assess the use of immersive technology to support the distant learner. Future research on VR in learning has the ability to close the persistence and attrition gaps between campus and online learners. Providing a strong online learning experience rooted in deeper learning and stronger connection with peers and teachers will allow more students to obtain a college education, which will result in a stronger society.
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APPENDIX A
Recruitment Email

Dear [Prospective Participant’s Name],

My name is Katie Ross and I am a doctoral student at Northeastern University. I am conducting a research study with the hope of learning more about online students’ experiences with virtual reality. This research excites me because a deeper understanding of how online students experience virtual reality has the potential to impact the tools that are utilized by educators to enhance online learning. This research will be conducted under the guidance and direction of principal investigator, Dr. Carolyn Bair.

The title of my research is: ONLINE STUDENTS’ EXPERIENCES WITH VIRTUAL REALITY: AN INTERPRETATIVE PHENOMENOLOGICAL ANALYSIS.

I would like to invite you to participate in my research study, which will help me to complete my doctoral dissertation. I am in search of 6-10 participants who meet the following criteria:

- At least 18 years of age
- Currently or previously enrolled in the University’s BS online degree program
- Enrolled or completed the online course that utilized VR for learning within 15 months of the study
- Utilized VR during the online course
- Agree to the use of audio and video recording of the interview; and
- Agree to the publication of the data collected from this study

**Participation is voluntary and completely confidential**

If you volunteer to participate in my study, you and I will engage in a one-on-one video interview using a secured video conferencing tool. With your permission, the interview will be recorded and subsequently transcribed. At the time of transcription, all names will be removed from the interview transcript, and pseudonyms will be assigned. All interviews will be kept completely confidential, and the student researcher and principal investigator will be the only individuals with access to the study information. All identifying information will be removed from the final study.
If you are interested in participating, please contact me at Ross.Kat@husky.neu.edu. Selection will be determined following a brief 5-10 minute screening call.

Thank you for your consideration and support,

Katie Ross
Doctoral Candidate
College of Professional Studies
Northeastern University

This study is being conducted by Kathleen Ross, an Ed.D. doctoral candidate at Northeastern University. This study has been approved by Northeastern University’s Institutional Review Board for research studies (IRB# CPS20-05-08)
APPENDIX B

Eligible Email: Scheduling the Interview

Dear [Participant’s Name],

Congratulations! You have met the criteria threshold to participate in my study, Online Students’ Experiences with Virtual Reality: An Interpretative Phenomenological Analysis.

I am writing to confirm your willingness to participate and to arrange a time for the interview that provides you with the most convenience and comfort. This study is voluntary, and there is no compensation for participation. Your participation in this research will contribute to the advancement of knowledge in the field of higher education.

Please see the attached consent form detailing your participation in the study. If you have any question regarding the consent form, you can email me.

Please email me with several dates and times that would be most convenient for you to schedule our video interview. Once I receive your availability and you complete the consent form, I will email you back to confirm the time, and will provide a link to our secured meeting in a video conference tool.

I will review this form with you fully when we meet and will be available to answer any questions that you might have about it. Please do not hesitate to contact me at any time with any questions at [CONTACT INFORMATION].

Thank you for your time.

Kathleen Ross
APPENDIX C

Informed Consent to Participate in a Research Study

Northeastern University, Department College of Professional Studies
Name of Investigator(s): Principal Investigator: Carolyn R. Bair, Ph.D.; Student Researcher: Kathleen Ross
Title of Project: Online Students’ Experiences With Virtual Reality: An Interpretative Phenomenological Analysis

Informed Consent to Participate in a Research Study

We would like to invite you to take part in a research project. The purpose of this research is to explore how virtual reality impacts online students’ connection to the course structure, feelings of autonomy, and interaction with both peers and teachers.

Key Information

- Your consent is being sought for participation in a research project and your participation is voluntary.
- The purpose of the research is to explore how virtual reality impact online students’ connection to the course structure, feelings of autonomy, and interaction with both peers and teachers.
- The anticipated amount of time that your participation will take will be 60-90 minutes.
- The procedures that you will be asked to complete will be answer a series of questions during a 60-90 minute interview that will be recorded using a secured video conferencing tool about your use of virtual reality in the online project and portfolio course for your degree program.
- The foreseeable risks to the subject are minimal, and physical risk is non-existent.
- The potential benefits to the subject are minimal, and the physical risk is non-existent.

We are asking you to participate in this study because you are an online student who used virtual reality during one of your courses. You must be at least 18 years old to be in this research project.

The decision to participate in this research project is voluntary. You do not have to participate, and you can refuse to answer any question.

Why is this research study being done?
The purpose of this research study is to explicitly address the connection between virtual reality and the impact it has on students’ online learning.

This study will allow policymakers, administrators, and teachers to make informed suggestions and decisions based on empirical research data as to how virtual reality can impact learners in
online learning to enhance student’s connections to the structure of their online courses, feelings of autonomy, and interactions with both peers and teachers.

**What will I be asked to do?**
If you decide to take part in this study, you will be asked to participate in a one-on-one audio and video recorded interview using a secured video conferencing tool to describe your experiences using virtual reality while enrolled in the online Project and Portfolio I course in the Game Design Bachelor of Science degree program.

**Where will this take place and how much of my time will it take?**
This researcher will reach out to you to schedule a one-on-one audio and video recorded interview before the interview is conducted to agree upon a time and date that provides you with the most convenience and comfort. The interview will take 60-90 minutes for each participant.

**Will there be any risk or discomfort to me?**
The possible risks or discomforts of the study are minimal. You may feel minimal emotional discomfort when providing your personal experiences and stories. To avoid this minimal risk, you may decline to answer questions or withdraw from the study at any time.

**Will I benefit by being in this research?**
There are no direct benefits to you for participating in the study. However, your answers may help us to learn more about how virtual reality can be leveraged in online learning to enhance the student experience.

**Who will see the information about me?**
Your part in this study will be handled in a confidential manner. Only the research team will know that you participated in this study. Any reports or publications based on this research will use only group data and will not identify you or any individual as being of this project.

All participant information including names and identifying information will not be connected to the resulting data and data anonymization will be used throughout the research process to ensure anonymity. Pseudonyms will be used to label all research data and all digital data will be password protected and only available to this researcher. Physical data will be kept in a locked location for the entirety of the research study with this researcher being the only individual with access to this location. Signed consent documents will be retained in a locked filing cabinet of which this researcher is the only one with the key for a total of 3 years following the end of the study.

**If I do not want to take part in the study, what choices do I have?**
You may withdraw from the study entirely at any time prior to the analysis of the data if you do not want to take part in it.

**What will happen if I suffer any harm from this research?**
Harm to you, the participant, is minimal, and physical harm to you, the participant, is non-existent.
Can I stop my participation in this study?
You may choose what you share with this researcher, and can decline to answer any questions or withdraw from the study entirely at any time. Participation in this study is entirely voluntary, and you can decide if you would like to participate in the study or not. Starting this research study does not commit you to completing the study and you can withdraw your participation at any time. You will not be penalized in any way, nor will you experience any kind of retaliation from this researcher or Full Sail University, if you decide to not participate or if you choose to withdraw from the study at any time.

Who can I contact if I have questions or problems?
If you have any questions about this study, please feel free to contact Kathleen Ross, the student researcher, by phone at [redacted] or email at [redacted], the person mainly responsible for conducting the research. You can also contact Dr. Carolyn Bair, the Principal Investigator, by phone at [redacted] or email at [redacted].

Who can I contact about my rights as a participant?
If you have any questions about your rights in this research, you may contact Nan C. Regina, Director, Human Subject Research Protection, Mail Stop: 560-177, 360 Huntington Avenue, Northeastern University, Boston, MA 02115. Tel: 617.373.4588, Email: n.regina@northeastern.edu. You may call anonymously if you wish.

Will I be paid for my participation?
You will not be paid for your participation in this study.

Is there anything else I need to know?
No cost is required of the participant to participate in this study.

____________________________________________  ______________________
Signature of person agreeing to take part          Date

____________________________________________
Printed name of person above

____________________________________________  ______________________
Signature of person who explained the study to the participant above and obtained consent          Date

____________________________________________
Printed name of person above

☐ I agree to be contacted for follow up or for future research studies

____________________________________________
Contact Information (email or phone)