The Observed Use of Technology Enabled Active Learning Classrooms and Interactive Learning Strategies in Higher Education: A Case Study

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Abstract

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The Observed Use of Technology Enabled Active Learning Classrooms and Interactive Learning Strategies in Higher Education: A Case Study

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To date, numerous institutions have transformed traditional lecture halls into technology-enabled active learning classrooms (TEALC) to adapt to the educational notion of "active learning" (AL). To investigate what occurs and how TEALCs are being used for teaching and learning, one of these spaces was evaluated in a midwestern university. The purpose of this single case study is to understand why and how instructors use these spaces and these technologies to help facilitate AL. It will help shed light on ways of using these spaces as well as different teaching strategies that help create an engaging learning environment. Six instructors' perceptions were investigated by collecting interviews, observations, and artifacts. The data was analyzed using NVivo software. Findings indicated that instructors were at ease when using these spaces and found that it shifted the teaching paradigm from an instructor-focused classroom to a more student-centered classroom. Findings also revealed that these spaces enhanced group activities, discussions, and student interactions. Barriers were also identified while using these spaces, such as large classroom sizes, insufficient time, and technology failure. Finally, the findings aid to further inform the administrators of practical training and professional development for future instructors in higher education.

Dedication

In the Name of God, the Most Gracious the Most Merciful

This dissertation is dedicated to my husband, Tareq, who has been my support during the challenges and the ups and downs of a Ph.D. student. I am truly thankful to have you in my life. This work is also dedicated to my parents Jasem and Kathleen Alreiahi, who have always loved me unconditionally and whose good examples have taught me to work hard for the things that I aspire to achieve. To my family and friends, you have all been so supportive and have always pushed me to my full potential. To my children Hanna, Barrak, and Lulwa Alderbas, this has all been for you.

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I give all praise and glory to God (Alhamdulillah). My faith is what kept me going knowing that I worked hard for what I accomplished. Prophet Muhammad, peace and blessings be upon him, said, "He who does not thank people, does not thank Allah" (Ahmad, Tirmidhi).

Conducting research, collecting data, gathering the literature review, analyzing the data, and writing up this dissertation has been a remarkable and strenuous experience. It genuinely takes a group of specialists who are willing to sacrifice valuable time to complete this research. My committee members were so very welcoming and generous with their time and their expertise. I am sincerely grateful for every one that made this a possibility. I want to express my gratitude to Dr. Kessler for agreeing to be my supervisor throughout my educational journey. You guided me to find my strengths and taught me so much. To my Deans Representative Dr. Dani, thank you for taking the time to be in my committee. Having your support, expertise, and encouragement has been so important to me. I would also like to thank Dr. Machtmes for all your support and help during the developments of this study. I owe further thanks to Dr. Strycker for providing direction, suggestions, and insights during the whole process of my dissertation. Your detailed comments really helped shape my dissertation for the better. I also wish to thank Dr. Wu for all your encouragement, ideas, and continued guidance and support. To Dr. Phillips, thank you for helping me with editing and fine-tuning my study. My final thanks go to my country Kuwait, and Kuwait University, for giving me this scholarship and this extraordinary opportunity to complete my higher degree. Thank you, and God bless.

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Chapter 1: Introduction

Technology has revolutionized the way we live, teach, and learn; from our basic everyday tasks to the most complex activities. Today's learners are at ease with using technology in personal and academic aspects of life. They are attending classrooms entirely online or in hybrid mode (O'Connor, 2012), using games and mobile apps to learn (Butgereit, 2016; DeWitt & Gloerfeld, 2018, Fan et al., 2016), and they are engaging in online learning communities and blogs (Shana & Abulibdehb, 2015). The last few decades have changed the way we see education, educators, and learners. Learning has become more versatile, flexible, individualized and essentially more learner-centered, making the classroom distance, online, face-to-face, and accessible anytime anywhere (Holland & Holland, 2014; Reigeluth et al., 2016, Spector, 2014). To satisfy these digital needs, higher education in many countries have implemented the use of instructional technology to help cope with the new trends in teaching and learning (Kirkwood & Price, 2014). Studies have continuously shown the positive benefits of technology integration, including, iPads, smartboards, computers, and other handheld devices (Kirkwood & Price, 2014). There is also a need for creating a more student-centered approach to teaching such as collaborative learning (Smith & McCann, 2001), problem-based learning (Savin-Baden, 2000), blended learning (Baepler et al, 2014) and the flipped classroom (Herreid & Schiller, 2013) to name a few. Fundamentally, these approaches are categorized under the theory of constructivism in education (DeVries, 2004). This is when the class has little or no lecturing involved. It is also when learning is done through a series of activities that can help the students develop cognitive skills,

engaging in hands-on activities and students work to improve a deep understanding of complex concepts through doing these tasks (Cooperstein & Kocevar-Weidinger, 2004).

As a result of emerging technologies and a more student-centered approach, the traditional views have changed dramatically to help adjust the teacher-student dynamics, which includes more technological tools, and interactive learning spaces that are designed to help achieve these goals. In addition to technology, one cannot ignore the learning spaces that play an essential role in the learning process especially in higher education (Kolb & Kolb, 2005). Therefore, many researchers have developed new ways to promote a more constructivist approach to teaching. One way is by active learning (AL), which is a type of engaging, collaborative environment that has been a topic of interest since the early 1990s (Meyers & Jones, 1993). Only in the last decade have universities tried to implement its concepts coupled with instructional technology to enhance learning (Baepler et al., 2016; Felder & Brent, 2009 Petress, 2008; Van Horne et al., 2012).

The concept of AL in higher education is not a new one. Bonwell and Eison (1991) defined AL as "anything that involves students in doing things and thinking about the things they are doing" (p. 2). AL requires learners to go through a series of educational activities while thinking about what the task is about and why they are doing it. Research shows that AL can enhance learner's memory, knowledge retention, and performance in exams (Cherney, 2008; Freeman et al., 2014; Prince, 2004). Teaching in higher education is changing, and so are the learners. Research shows that learners do not learn well when they are passive (Benware, & Deci, 1984; Haidet, 2004; Michel et al., 2009). Active learning strategies help learners become critical thinkers, problem solvers, and collaborators of their own learning process (Bean, 2011). These strategies and

teaching methods can be best seen in active learning classrooms (ALCs), which, may support collaborative and active learning (Baepler et al., 2016; Prince, 2004). Recently, AL has been combined with the use of instructional technologies. Dori and Belcher (2005) conducted a study that has shown that “well-designed educational technology" helps to foster "individual and group thinking, supported by educational technology, and small and large group discussions for knowledge building” (p. 274). The trending concept is to provide a collaborative learning space that helps support AL by creating flexible seating, roundtables, and the technology to help facilitate learning (Baepler et al., 2016). Some of these innovative ALCs are; SCALE-UP classrooms, which stands for Student-Centered Active Learning Environment with Upside Down Pedagogies (Beichner, 2008), TEAL Technology- Enabled Active Learning (Long et al., 2016), and TILE, which stands for Transform, Interact, Learn, Engage (Van Horne et al., 2012).

For the purpose of this research these learning spaces will be addressed as Technology Enabled Active Learning Classrooms (TEALC). The main benefit of TEALCs is that they enable learners to have access to more recourses that can help them with their learning process as well as have a collaborative learning environment to help facilitate critical thinking and problem-solving skills. The success of these types of teaching has already been established in the literature (Baepler et al., 2016). A systematic review of the studies regarding the success of AL in higher education has been compiled by Freeman et al. (2014) in the field of science, engineering, and mathematics. They reviewed 225 studies of university instruction that compared traditional lecture-style classrooms to a more AL environment in undergraduate science, technology, engineering, and math (STEM) courses. The meta-analysis suggests that there is a positive outcome

for learners who have been in the ALC. Their performance on exams increased, and learners in the traditional lectures were 1.5 times more likely to not pass the course.

Despite the vast amount of research that explored learner's perspectives of using TEALCs in education (Braxton et al., 2008; Dori & Belcher, 2005; Swan, 2001; Trees, & Jackson, 2007; Lumpkin et al., 2015), very few studies have touched on the instructor's viewpoint and opinions on the matter. Research exploring how teachers in higher education use these spaces and their views about learning-centered spaces is limited (Price, 2004; Van Horne et al., 2014). Faculty attitudes, teaching philosophies, and strategies that promote AL, student engagement, and effective teaching methods are all essential elements for academic success in the undergraduate level (Barkley et al., 2014; Campbell & Blair, 2018; Gebre et al., 2014). Moreover, there are concerns regarding the need for faculty members to develop teaching strategies using technologies and instructional methods (Uerz et al., 2018). Instructors graduate with degrees but have little or no teaching experience prior to when they begin teaching. Therefore, the need for better preparing these instructors, especially during their graduate program is critical. Additionally, understanding how they perceive teaching, especially in a high-tech environment is also an essential element of ensuring a more student-centered approach, where learning is more important than lecturing. It will also help provide a roadmap for other instructors to follow when implementing AL in their classrooms (Baepler et al., 2016; Birdwell et al., 2016).

Statement of Problem

While promoting the use of technology-rich tools in ALCs in higher education is a vital skill set to have with any university teaching staff, making an easy transition into

these innovative learning spaces is still a major challenge for educators and educational institutions today (Baepler et al., 2016). For instance, successful technology integration requires practice, time, and commitment as well as a sense of expertise in the correct way to implement it in the classroom (Birdwell et al., 2016; Bean, 2011). This has been difficult because faculty frequently describe that lack of time as a barrier of effective use of these technologies in the classroom (Miller & Metz, 2014). In addition to this, instructors require both training and support in how to apply these technologies at a technical level and at a teaching level, which may not always be present or readily available to faculty. Another issue to consider is that when these technologies and support are available, they tend to be more focused on mastering the technical aspect rather than trying to develop the correct strategies to implement technology in order to enhance learning (Baepler et al., 2016). In the absence of robust professional development opportunities, instructors and faculty usually gravitate towards using tools that they are familiar with and that they are comfortable with, leading to the underutilization of the innovative technology in a technology-rich environment such as the TEALCs. Additionally, the lack of literature regarding practical ways to implement TEALCs in higher education permits more in-depth research in this area (Prince, 2004). Thus, there is a need to identify successful AL strategies, coupled with using technology tools in undergraduate teaching lectures. This will help ensure that faculty have sound guidelines for employing this type of teaching to help create a more learner-centered approach to education (Baepler et al., 2016; Bean, 2011; Birdwell et al., 2016).

Purpose of Study

The purpose of this study was to examine university instructor's perceptions of effective teaching when using TEALCs in higher education, specifically in teaching the undergraduate level in all disciplines. In addition, it seeks to find out what they identify as effective teaching practices and strategies. The study will also explore the pedagogical rationale behind their decisions when choosing technologies and how they fit into an ACL. This will help understand what techniques are used and why. The results of this study may be used to fill the gaps in the present literature and better inform faculty professional development programs in these areas. In recent years, the financial investments that universities and educational institutions have made in instructional technology and the construction of technology-rich classrooms has warranted the need to explore the best ways to help support instructors in the use of these spaces and these technologies in their teaching. Additionally, the results of this research may provide reflective insights into best practices in using TEALCs as well as provide thorough professional development for instructors.

Significance of the Study

Fostering AL in higher education is not an easy task. Instructors are key in the successful implementation of this innovative teaching method. The application of these methodologies is not just "let's try that new way of teaching" and see what happens, rather it needs to be studied and understood, and it needs to work for other instructors to adopt it in their teaching, which will in turn change philosophical notions of learning for both the instructor and the learner. Therefore, the aspiration is that this research will give possible solutions for future professional development and training in this area. AL

methodologies are based on collaboration, reflection, critical thinking skills, problem solving skills, and contextualizing information (Baepler, 2016). Given that previous research has found that these spaces have a positive impact on undergraduate students learning process and success, it is imperative that instructors change their teaching styles to a more learner-centered teaching classroom (Birdwell et al., 2016). The notion of success in higher education should not be entirely limited to performance evaluations, assessments, grades, and tests; it must also embrace the notion of a long lasting and enjoyable experience that is portrayed by the acceptance of both the instructor and the learner (Bonwell & Eison, 1991; Trees & Jackson, 2007). The assumption is that researching instructors' perceptions of how to utilize these spaces will yield a better understanding of instructors' choices regarding technological choices, interactive strategies used, AL strategies and activities employed, and overall satisfaction of this method of learning. The results may also help shed the light on leaner-centered paradigms in terms of providing valuable feedback for undergraduate instructors and professional development administrators at the university.

Research Questions

- How do instructors utilize TEALCs?
- What strategies do instructors employ to facilitate interactive learning?
- What are instructors' perceptions of TEALC?

Research Site

For this study, the TEALC that is examined is at a large research university in the Midwest. The university recently created this TEALC and has encouraged instructors to teach in the space regardless of the discipline or program. I chose this TEALC because it

is fully equipped with the latest technology and the space is designed for promoting AL. The research site will be addressed in depth in chapter three of this dissertation.

Delimitations

I delimited this research to instructors teaching in TEALCs in higher education at one university. The focus was specifically on the instructors use of technologies, teaching methods, and their perceptions in one space. I did not include the learners' perceptions for this study, nor did it provide information about them. I also did not investigate specific learning outcomes based on the observations of the class and the instructors used of these technologies, as this was beyond the scope of the research questions. Whilst the aim of this study was to investigate instructors' use of technology and their pedagogical choices in the TEALCS learning space, online platforms such as Blackboard of other learning management systems (LMS) were not included.

Definition of Terms

Below are a few terms used throughout this dissertation for purposes of this research:

Active Learning (AL): The general definition of AL is "any instructional method that engages students in the learning process" (Prince, 2004, p. 1). Bonwell and Eison (1991) also define active learning as "students doing things and thinking about the things they are doing." (p. 2).

Technology Enabled Active Learning Classrooms (TEALCs): it is **"**a pedagogical innovation established in a technology-enhanced multimedia studio, emphasizing constructivist-oriented teaching and learning" (Shieh, 2012).

Interactive lecture: This type of lecture focuses on the interactions that take place between the instructor the students; the students are not passive listeners (Rodger, 1995).

Organization of Chapters

This dissertation includes five chapters. The first chapter is an introduction to this case study research, discussing the purpose, the significance, the limitations and delimitations, and the research questions. The second chapter reviews the literature on active learning and TEALCs in terms of the history, teacher preparation, theoretical background and uses of AL in higher education as well as other topics related to AL. Chapter three defines the methods of the data collection, the study process and its considerations, and the analysis process of this research. Chapter four highlights the main findings and the themes that were generated from the analysis process. Finally, chapter five provides the discussion, implications, and future research. In addition, further details about the study are accessible in the appendices at the end of this dissertation.

Chapter 2: Literature Review

This chapter focuses on the literature regarding AL and its history, learning theories, spaces, and related trends. It is important to understand the impact of AL spaces, and AL strategies have on the learning outcomes. This will provide a basis for supporting faculty and better preparing them to teach in active learning environments.

The Active Learning Concept

Amidst the previous research regarding the most effective ways people learn, active learning is considered a prominent method (Bransford et al., 2000; Prince, 2004). AL can be related to the famous Confucius (551-479 BC), who stated, *"I hear and I forget. I see and I remember. I do and I understand"* (Saeedi & Hamedi, 2018). It is a term used to describe a model of engaging learners in their learning process (Baepler et al., 2016; Prince, 2004). Active learning is not a theory *per se* but is a teaching method that supports the process of learning. This method uses strategies that involve problem solving, asking questions, creating connections, applying knowledge to promote reflection, synthesis of information and analysis, which in turn guides learners toward specific learning objectives (Cleveland et al., 2017, Long et al., 2016). Research indicates that when learners are actively engaged, they understand the topic better and it helps increase retention, reflection, and knowledge (Baepler et al., 2016, Freeman et al., 2014). The successful implementation of AL entails shifting the focus from the instructor to the learner and creating a more learner-centered classroom. This can be achieved by creating engaging guided tasks, collaboration, interactive activities, and strategies. This theory stems from constructivism, which is essentially learning through the construction of knowledge that occurs when learning is achieved by collaborating with others (Bull,

2009). Essentially, AL focuses on learning by doing rather than just listening (Prince, 2004). The aim is to design lessons that help elicit active engagement and participation where learners take charge and manage their own learning process (Bransford et al., 2000; Braxton et al., 2000; Felder & Brent, 2009). It is fundamentally changing the traditional method of teaching and instruction, to become a more collaborative, multipurpose teaching setting (Baepler et al., 2016).

Bonwell and Elison (1991) defined AL as "anything that involves learners in doing things and thinking about the things they are doing" (p. 2). The authors highlight that learners must be actively engaged in activities that involve synthesizing and problem-solving. Fleder and Brent (2009) also described AL as "anything course-related that all learners in a class session are called upon to do other than simply watching a lesson and taking notes" (p. 2). Therefore, for learning to be active, learners not only need to be contributing to a task but also need to assess and reflect on what they are doing and why. It is evident from these definitions that this type of learning is learner-centered and requires learners to complete meaningful activities that are linked to real-world problems and skills (Bonwell & Elison, 1991; Cohn et al., 1994). There are many theories and terms related to AL. Methods such as cooperative learning, collaborative learning, and problem-based learning all have similar attributes to AL. They help promote "active engagement" and enhance learner motivation and provide "critical and creative-thinking capabilities" (Davidson & Major, 2014, p. 45). Svinicki and McKeachie (2011) emphasized that AL activities are essential because they:

a) "Connect new concepts with students' existing knowledge
b) Eliminate the 'illusion of understanding'

c) And, motivate students to do something rather than passively hear lectures." (pp. 169-70)

The idea is that learning is not based on memorization; rather, it is creating a deeper understanding of the topic. It encourages learners to solve problems in different contexts. Also, it is a way to help create more autonomous learners (Birdwell et al., 2016). Moreover, adding instructional technology to the ALC helps create a more dynamic classroom (Anderson et al., 2007). Using apps, iPads, smartboards, laptops, and smartphones during the classroom are just some ways teachers can utilize instructional technology in the classroom. It is important that instructors are able to design activities that help support the course learning objectives, keeping in mind the context, the subject manner, instruction delivery method (online or face-to-face), and the duration of the lesson (Beichner, 2016; Misseyanni et al., 2018; Uerz et al., 2018).

Research shows that AL can enhance learner's memory and knowledge retention (Cherney, 2008; Freeman et al., 2014; Prince, 2004). It is important to note that not all learning in the TEALCs is classified as active. The lesson or the class time varies. Some activities are clearly active and some as considered passive or receptive. This depends on the way the instructor prepares and sections the class. In a traditional classroom setting, the instructor is the center of the lesson. Learners sit in a row of desks and chairs, with minimal or no social interaction. They receive the lesson and are given homework on that lesson to complete at home. Whereas, in an TEALC environment, the homework, activities, or other engaging tasks are introduced in the lesson as part of the teaching instruction. The primary foundation of this type of teaching is for the learning to be in

groups, activities are hands-on, everything is a collaborative effort and the aim is to solve problems and complete engaging tasks (Baepler at al., 2016).

Learning Theory

In order to understand what AL is, it is important to discuss the theories that led to active learning. Epistemology is the exploration of the origins, nature, processes, and boundaries of human knowledge. These explorations encouraged the development of knowledge and theory (Hofer & Pintrich,1997). This part of the literature review will look at the theories that are central for understanding AL.

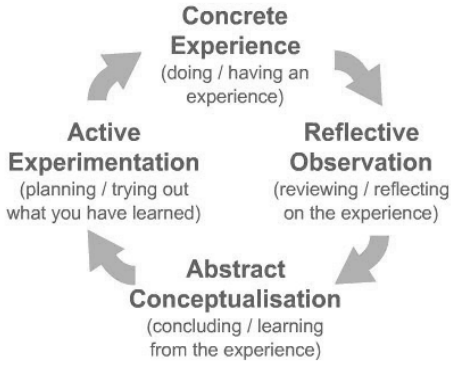
Kolb's Learning Cycle

Kolb's learning cycle is a theory that offers a practical framework for learning. The model is based on the influences of Dewey's (1938) educational theories, as well as a form of Piaget's (1970) theory of cognitive development. According to Kolb (1984), "learning is the process whereby knowledge is created through the transformation of experience" (p. 41). The theory is divided into four stages which creates a learning cycle: Concrete experiences, where the learning experiences occur, reflective observation, which is when the individual actively reflects on the experience, abstract conceptualization, which is when the individual is presented with a theory or a new concept, and active experimentation, where the individual tries to test the theory (Kolb, 1984). Kolb argues that this cycle of experiential learning may be applied to all learners (see Figure 1). The model also focuses on the reflection component of this process. Reflection is considered essential for the observation process in evaluating and recalling the learning experience. Kolb (1999) argues that the two cycles, concrete experience and abstract conceptualization are critical for the reflecting right-brain and left-brain thinking.

The research that tested the model's effectiveness is well documented in the literature (e.g., Healey & Jenkins, 2000; Kayes & Kolb, 2005a, 2005b; Kolb, 2014; Moon, 2013).

Figure 1

Kolb's Learning Cycle (McLeod, 2017)



Constructivism

In addition to Kolb's learning cycle, AL stems from the theories of constructivism. Constructivism is rooted in the philosophies of psychologists and educators in the field of cognitive learning (e.g. Dewey, Piaget, Vygotsky). Constructivism "is how people make sense of their experience" (Merriam & Caffarella, 1999, p. 260). In other words, it is the way students construct their knowledge to make meaningful connections between this knowledge and the environment around them. Duffy and Cunningham (1996) suggest that this theory is grounded in two common principles: a) Learning is an active process that is done by constructing information rather than obtaining it, and b) the instruction given is a way to assist and support the construction of this information. This theory helps shift the learning process from teacher-led to student or learner-led learning.

The constructivist learning environment is a space where learners are responsible for the construction of their knowledge by actively building on their understanding of a topic rather than becoming a passive learner. The aim is to build on prior knowledge and create the new experience by social interactions, stimulations, and collaboration (DeVries, 2004). These types of classrooms focus on students developing behaviors and skills that assist in future learning (Richardson, 2003). Yilmaz (2008) provided the underlying assumptions and principles that have been summarized in the previous literature:

- Learning is an active process;
- Learning is an adaptive activity;
- Learning is situated in the context in which it occurs;
- Knowledge is not innate, passively absorbed, or invented but constructed by the learner;
- All knowledge is personal and idiosyncratic;
- All knowledge is socially constructed;
- Learning is essentially a process of making sense of the world;
- Experience and prior understanding play a role in learning;
- Social interaction plays a role in learning. (p. 167)

Social Constructivism

Social constructivism focuses on the cultural aspect of learning and how learning occurs in a social setting. Vygotsky (1978) argued that cognitive growth initially occurs on a social level and then develops on an individual level. Phillips (2000) stated social

constructivism is built on “human constructs” which have been formed by policies, values, ideologies, religious beliefs, and economic status. In other words, these social factors affect the way individuals understand what is happening around them. Thus, learning takes place when there are meaningful interactions. This knowledge can be constructed when individual work together to exchange experiences, opinions and ideas (Amineh & Asl, 2015; Yilmaz, 2008).

Active Learning as an Educational Approach in Higher Education

As previously mentioned in chapter one, AL can be associated with other learning approaches such as collaborative learning (CL), team-based learning (TBL), problem-based learning (PBL), and cooperative learning. The idea of collaborative learning is learning that takes place in a group or where two or more individuals attempt to learn something together and share a common academic goal (Dillenbourg, 1999; Gokhale, 1995). This definition is similar to cooperative learning where students can work in pairs or groups but are assessed as a group and on their performance as a whole. Assessment can take many forms in cooperative learning (Felder & Brent, 2007; Price, 2004). It is important to note that both of these approaches are considered learning in a social context. Prince (2004) asserts that “cooperation is more effective than competition among students for producing positive learning outcomes” (p. 5). In other words, the success of the learning process depends on learner participation, discussion, and partnership rather than working individually. In addition to these approaches, problem-based learning (PBL) is another learning approach that focuses on a problem that needs to be solved, thus creating a collaborative atmosphere where students work together to find a solution for this problem. This type of learning helps learners acquire problem solving skills, and

fosters critical thinking (Savery, 2015). Moving on to team-based learning, which is another approach that is close to AL because the learners work in teams or in groups. It is also another form of cooperative learning but has more constraints such as creating permanent teams or groups, being accountable for their team and their work, providing feedback frequently, and creating assignments that meet both learning and team development goals (Michaelsen & Sweet, 2011). All of the above educational approaches have similar characteristics to AL and in some cases, AL unites all of them together. Active learning is not just busy work, it is purposeful instruction that is aimed at specific learning outcomes (Baepler et al., 2016).

Traditional Lectures

The traditional teaching approach or lecturing is, arguably, the oldest and most common type of instruction at a university level. It is didactic and mostly involves covering the textbook, the material, and the curriculum as a way to help cover as much knowledge as possible during the lecture time. Additionally, the teaching remains unilateral, which is considered to be mostly teacher-centered (Burgan, 2006; Horgan, 2003). Some scholars argue that traditional lectures are passive in nature, an orthodox method, rigid, and a failed attempt to transmit knowledge, which in turn generates shallow, surface thinkers that rely on memory rather than critically and creatively understanding the content (Regmi, 2012). This type of learning is what educators are trying to avoid.

Advantages of Traditional Lectures

Although there are many criticisms regarding traditional lecture, they do have many advantages. Bonwell (1996) summarized the advantages of the traditional lecture

by stating that lectures help present material that is not available to learners and that can be imperative to their knowledge acquisition. Lectures also help present a large amount of information to a large number of learners in a shorter time. In addition, lectures allow the instructor to organize the information to suit a particular audience. They also cater to the auditory learners.

Lecturing with Active Learning

Harrington and Zakrajsek (2017) ague any lecture can turn into a 'dynamic lecture' by providing teaching with strategies, and teaching methods that help turn a tedious lecture into an effective teaching opportunity. They affirm that lecturing should not be an abandoned skill and that is the best way to help with the foundation of knowledge. Once they have the foundation, then activities that promote AL can be introduced. They argue that lecturing does not need to be replaced with AL, rather, a traditional lecture can be effective if AL is supplemented into the traditional lecture or classroom. Harrington and Zakrajsek (2017) also state that there are ways to lecture. The first main key concept of effective lecturing is activating prior knowledge with activities, this gives the learner a concept or a point to start with in order to expand on that point (p. 39). The second concept they argue for is using auditory or physical lecture pointers to help emphasize on the important parts of a lecture. These can be done in chunks throughout the lecture or as pauses. This can be done by using signalizing techniques (p. 70). They argue that visual aids help the learner go from one point to another or emphasize a certain point during the lecture or PowerPoint presentation. Other topics that are important to the lecture is providing pauses where the instructor can focus on questions that help critical thinking, and memory retention. Research shows that

individuals differ in attention span and may lose attention after a period of time (Revell & Wainwright, 2009; Wilson & Korn, 2007). Therefore, a lecture longer than 20 minutes may drastically drop attention span and learner interest. This is why including an activity to break up the length of a lecture is advised. The activity can be a collaborative one, it can also be an individual activity or a group project.

Interactive Strategies in Higher Education: Involve, do not Lecture

In general, lectures are taught in university settings with the learner being passive and the instructors giving information to the students. However, studies have shown that lectures do not foster critical thinking or learner engagement (Freeman et al., 2014). Lecturing is still the dominant way of instruction even today, despite the attempts of instructional technology and different methods of teaching to shift that way of teaching (Marris, 2018). Research indicated that this type of passive learning is not the most efficient way to help the learner understand the content and promote active learning and engagement (Freeman et al., 2014; Schmidt et al., 2015). There are many reasons why traditional lecturing is outdated and efficiently inadequate. Bradbury (2016) explored the notion of learner's attention span during the lesson. There is a belief that learners' attention declines after about 10–15 minutes into the lesson, however, Bradbury argued that this is may not always be the case because the attention span differs from learner to learner. The evidence suggests that instructors need to be aware of these differences when teaching by providing various ways to utilize the time to help focus on these different learning styles and attention spans. This can be done by creating an interactive lesson using the active learning concept.

Cleveland et al. (2017) conducted a study that investigated the association between instructors' use of active-learning strategies and students understanding in an undergraduate biology class. The researchers also wanted to observe how instructors with diverse experiences and training implement active learning strategies in a biology course and to measure the impact of active learning on understanding, attitudes, and motivation toward learning biology. They focused on the strategies and activities that were considered active learning such as clickers and graphic organizers. The participants were two instructors that had classes that ranged from 100-250 students. They looked at years of experience and training received in active learning. In addition, there were 132 students who participated in the study by trying these activities in a traditional classroom. The results indicated that using active learning strategies helps promote student learning. They also stated that it is important to choose the best strategies that suits both the learner and the instructor, and a deep understanding of how AL occurs is also crucial to the successful implementation of these strategies (Cleveland et al., 2017).

There are major characteristics that are associated with this active learning. According to Eison (2010), AL entails learners "thinking critically or creatively, speaking with a partner, in a small group, or with the entire class, expressing ideas through writing, exploring personal attitudes and values, giving and receiving feedback, and reflecting upon the learning process."(p. 1). For learners to develop these critical skills they are exploring new information rather than listening, they are analyzing and synthesizing and evaluating information rather than taking notes. There are well-established techniques in the literature that help with active learning. These activities are also related to collaborative learning and interactive strategies. Dividing the lesson into chunks,

providing chances for learners to reflect and retain information, and giving various collaborative activities are essential parts of the classroom dynamic (Dori et al., 2007).

Roopa et al. (2013) investigated the efficacy of interactive lectures for 78 first year dental students at a university in India. They studied the reactions and perceptions of these learners when using interactive lecturing techniques in 12 lessons. Results indicate that when the lesson is divided into segments, learners felt that they were more useful than regular lessons. They were more involved, attentive, and motivated. The interactive lessons included video segments, and an activity called "each one - teach one" where the professor would stop for a minute or two after each segment to give the students a chance to discuss a point covered with their neighboring peer. The learners found that these methods were beneficial to the learning process. Similarly, Lumpkin et al. (2015) examined the use of exploratory writing assignments, group and pair dialogs, minute papers, and reporting orally to the whole class to integrate active learning in five different undergraduate courses. Results indicate that these types of interactive activities facilitated increased understanding, recall, and clarity of information. The activities gave learners an invigorating break, and they were enjoyable for them because it gave them a chance to interact with the information.

Active Learning/Interactive Strategies

Active learning is not used for groups only, but can be individual activities, self-reflection, and peer evaluation. Wolff et al. (2015) provided a clear outline of these interactive activities that can be used in large or small classrooms. The next section will include some of these activities for individual learners, group work, discussions,

problem-solving, feedback, think, share and pair, and collaborative/team learning. These strategies are based on Faust and Paulson's (1998) interactive strategies.

Activities for Individual Learner Engagement

Learner engagement is considered a significant part of AL. It has been previously coined as "*the holy grail of learning*" because if the learner is activity engaged, it will provide lifelong learning skills (Sinatra et al., 2015, p. 1). The literature indicates that active engagement in the classroom is crucial for academic success (Chi & Wylie, 2014; Chong et al., 2018; Lawson & Lawson, 2013). Axelson and Flick (2010) suggest that learner engagement is divided into three ways: behavioral, emotional, and cognitive engagement. Research also shows that there is a link between learner engagement and learner outcomes such as grades, learner motivation, and university completion (Chong et al., 2018; Lawson & Lawson, 2013). Instructors have the ability to influence learner engagement by changing their instruction to promote thoughtful integration of activities that enhance learning experiences. The following activities may be used as fillers or activity breaks for specific topics. The instructor introduces the topic and then can divide the lesson utilizing the following activities:

The One-minute Paper

Stead (2005) argued that this low-tech activity helps learners reflect on learning, gain valuable feedback, and dramatically improves test performance and learner understanding. The one-minute paper is a type of formative assessment. It can be done in a short amount of time; it can be open-ended or a specific question, which can be used to transition from one topic to the next or as an exit ticker. Example questions to ask would be "what is the main idea of today's lesson?" or "What is your central takeaways from

today?”. These types of questions help learners think about the information critically. More recently, the minute paper has been used in combination with social media applications, specifically in conjunction with taking 'selfies' (Meehlhause, 2016).

Meehlhause (2016) discussed the implications of the minute paper and makes a case for the new form of using the minute paper with technology by having students take a selfie with a checked-out book at the library. Meehlhause argued that using selfies with the minute paper will help gain an understanding into learners’ skill development and retention. Students feel familiar with these apps and it can be a way to use these technologies to help enhance to teaching experience. This activity can be adaptable to different subject areas and enables learners to actively use the skill learnt, rather than being passive.

Daily Reflective Journal Entries

This activity allows for a more in-depth understanding of the topic (Faust & Paulson, 1998). This activity also encourages reflection and self-questioning (Cowan, 2014). Journal writing can be done in class as a 5-min activity at the end of the day, or a way for learners to work individually on a personal blog or website to add their reflection on the topic or article being discussed. Al-Rawahi and Al-Balushi (2015) conducted a study that investigated the efficiency of grade-ten students' reflective science journal writing on their learning strategies. They looked at 62 students in Oman, including 32 students in the experimental group and 30 students in the control group. In the experimental group, students had to write in a reflective journal after their science lessons. They were asked to reflect on the scientific observation, the conclusions and their level of understanding as well as personal feelings and learning goals. The control group, on the other hand, studied the same unit minus the reflective journals. The results indicated that the participants in the journal-writing group significantly outperformed those in the control group with respect to their self-regulation strategies. The researchers recommended using reflective journal-writing to help with student retention, and self-learning strategies.

Chang and Lin (2014) investigated the effects of reflective writing using e-journals in a higher education setting. They looked at how learners used e-journals for an English as a foreign language (EFL) online course. A total of 98 undergraduate students participated in the study. Similar to the study by Al-Rawahi and Al-Balushi (2015), they had a control group used online reflective e-journals, while the control group only completed the exercises. The results indicate that using reflective e-journals enhanced

learners reading comprehension, and it improved their overall writing abilities and organizational skills.

Clarification and Explanation Breaks During the Lesson

This is an easy technique to help foster active listening. Essentially, active listening is developing a "clear understanding of the speaker's concern and also to clearly communicate the listener's interest in the speaker's message" (McNaughton et al., 2008, p. 224), especially after discussing the relevant parts of the lesson. The instructor can stop and give the learners a moment to digest the information and ask if they need clarification or if they want to give their point of view regarding the topic (Faust & Paulson, 1998). Nilson (2016) suggested that asking questions is important to insure comprehension and emphasizes that a clarification questions "invites the student to rephrase or elaborate on her ideas to make them more understandable to the rest of the class. It may include a request for an example, an application, or a fuller explanation." (p. 141)

Activities for Group Collaboration

Asking questions during the time of the lesson stimulates the way learners respond to the topic. Asking the right questions help tests learner comprehension and increases learner involvement in the lesson. Breaking up the class into smaller groups can assist in student conceptual understanding (Baepler et al., 2014; Rice, 2017). Rice (2017) provided several activities that help instructors choose meaningful pauses that help with metacognition, retention and understanding. He encourages pauses that help learners digest information in the form of activities such as pair stump, trivia, and twitter start (Rice, 2017). These collaborative activities help learners become engaged, and active.

The Socratic Method

This activity involves asking questions to a learner, and if this learner cannot answer, the instructor chooses another learner to complete the answer. This continues until the designated answer is obtained. There has been some criticism regarding this activity. Some claim that this type of method singles out and embarrasses learners in the process. Another claim is that it gives favor to a small part of the class (Faust & Paulson,1998). Oyler and Romanelli (2014) argue that the instructor needs to be well prepared because "effective Socratic questioning takes time, effort, and practice and ultimately may be more difficult for the educator than the learner." (p. 6) Therefore, if done well, this technique can have benefits for the classroom dynamics.

Numerous studies have been conducted on the effectiveness of using the Socratic method in their teaching (Byrne, 2011; Shahsavar et al., 2013; Suhadi, 2016). Shahsavar et al. (2013) conducted a 14-week long study that investigated Socratic discussions between 40 undergraduate students. The lecturer was a facilitator of these discussions that took place twice a week online and face-to-face. The results indicate that this method significantly enhanced students' critical thinking skills. Accordingly, other studies showed that it is crucial to provide the appropriate questions in order to provoke students' thinking and promote higher order thinking skills (Elder & Paul, 2007).

The Fish Bowl Activity

This activity has many variations. One activity is that the learners are provided with index cards and are asked to note down one question about the topic. Faust and Paulson (1998) argued that this can help learners get clarification about a topic. These items are then put into a fishbowl and the instructor can choose from the bowl to ask the

learners. The other more advanced version of the fishbowl is creating an inner circle of participants as well as a larger outer circle. The fishbowl discussion activity is an interactive dialogue technique that promotes dialogue, debate discussions and promotes participation (Chisholm & Quillen, 2016; Miller & Benz, 2008; Mucke, 2018). Additionally, it allows learners to construct meaning and improve interpersonal communication skills (Cummings, 2015).

Mucke (2018) conducted a study at the European Lupus meeting in March 2018 to assess attendees' attitudes concerning the effectiveness of the fishbowl method. A total 10 fishbowl discussion groups were created, and each group was assigned a topic. Each group had a moderator or an (expert), a patient with the lupus, a fellow in training and two more experts in the disease. The discussions lasted for one hour. The study was evaluated using an online survey that was distributed via email after the conference. A total of 169 surveys were analyzed. Results indicated that the activity stimulated active participation. Seventy-three percent of the participants agreed that the fishbowl discussion is effective and 72.7% agreed that this method of discussion was more diverse than other methods. These results are consistent with research in other disciplines such as learning English speaking skills (Yustiati et al., 2015), mathematics (Siagian & Surya, 2017), and reading (Nisa, 2016).

Think Pair Share Activities

Meyer and Hunt (2017) suggest that interactive lessons using these techniques promote active learning. Think-pair-share activities help learners digest the information. It can be done in pairs or groups. The professor poses a question and gives them time to

find the answer, then in pairs, they compare responses and discuss their understandings before reporting back to the classroom (Demirci & Düzenli, 2017).

Kothiyal et al. (2014) explored how successful (think, pair, share) activities are in an undergraduate course. The results indicate that most of the learners agreed that these activities helped with their understanding. Results from another study by Sahardin et al. (2017) showed that this technique improved students' abilities in writing and increased their organization skills, vocabulary content and grammar acquisition. Similarly, Li et al. (2017) found that think pair share was effective in brainstorming and preparing second language learners for listening comprehension. The results indicated that it helped activate prior knowledge, increase self-assurance for the examinations, decrease performance anxiety, built links to personal life experiences and stimulated the generation of new thoughts. This activity has also been documented to help facilitate meaningful learning (Demirci & Düzenli, 2017; Kothiyal et. al., 2014; Prahl, 2017).

There are some points that need to be considered when trying out this activity. Prahl (2017) suggests that before generating the questions, learning outcomes need to be considered. Another point to consider is that the activity should be in line with the assessment question to help evaluate the result of the activity. Prahl goes on by stressing that it is best to have open ended questions with multiple possible answers. Additionally, it is important to create questions that support collaborative learning and that encourage learners to focus on others' opinions. Finally, questions should encourage discovery and exploration (Prahl, 2017).

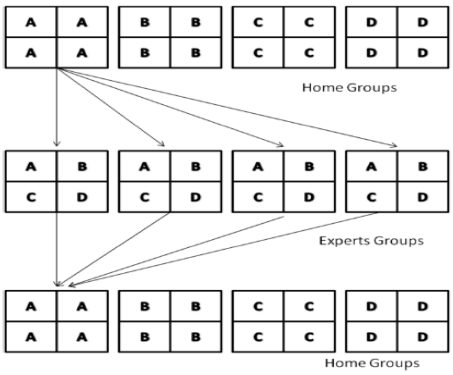
Jigsaw Group Projects

Another valuable discussion activity is the jigsaw puzzle. The jigsaw method is becoming a well-known and widespread method of instruction in higher education (Azmin, 2016; Karacop, 2017; Sabbah, 2016; Yu, 2017). The idea is that learners work together in small groups, while helping each other on one project. The first step of this activity is dividing the class into teams, which are often called home or mother teams. Next, the reading material or the topic is divided so that each team has a different topic to cover. After discussing their own topics and becoming "experts" in that topic, the learners are put into "expert teams" being that they form new subgroups of each topic studied. The cocktail of team members discusses their expert ideas and then return to their original home group (Buhr et al., 2014; Dhage et al., 2016; Yu, 2017).

The following figures illustrate the grouping and regrouping grouping and regrouping.

Figure 2

Protocol of Jigsaw Activity (Dhage, Patil, & Pawar, 2017)



This activity encourages student participation (Buhr et al., 2014; Sabbah, 2016). Clarke (1994) adds that this activity helps learners "synthesize" and share key aspects of the topic with group members. Additionally, the method helps learners become better communicators, and team members because they have to work together (Bhandari et al., 2017). According to Sabbah (2016), the jigsaw method improved reading comprehension among ESL students at a community college in Qatar. Another study conducted by Karacop (2017) looked at the influence of the jigsaw method on pre-service teachers in physics in science teaching laboratory practice courses. They concluded that pre-service teachers had higher level of achievement in the sessions that had the jigsaw activity than the other type of method. Similarly, a study by Bhandari et al. (2017) on medical students who were learning physiology and found that "the Jigsaw method to be a healthy way of interacting with peers, making learning interesting and effective" (p. 320). From the literature, it is definite that this is useful activity for the active learning environment because it is essentially collaborating, synthesizing and acquiring knowledge through interactions, and communication, which is considered especially active in nature.

Brainstorming and Mind-mapping Activities

Kolb and Kolb (2005) stress that learners have various learning styles. They identified four learning styles: diverging, assimilating, converging, and accommodation. Brainstorming helps diverging learners who perform better when they collect data from the different point of views and create their understanding of the topic. The instructor is mostly the primary facilitator to provide various learning activities to suit these learners, therefore, giving braining-storming and mind-mapping activities provide these learners with a topic or problem and gives time for learners to generate connections, ideas, and

relationships. After a few minutes, the instructor discusses learner input with the whole class.

Mind mapping is a great way to organize the brain storming activity. Mind maps help learners actively acquire information. It is considered a learning approach to help learners synthesize information, organized concepts and establish ideas (Abdel-Hamid, 2017). Several researchers have established the effectiveness of this learning approach and have documented its success in higher education (Abdel-Hamid, 2017; Kalyanasundaram et al., 2017; Shraddha et al., 2015). Tee (2014) noted that mind mapping was developed by Tony Buzan, he stated that a mind map is made with "central image, main themes radiating from the central image, branches with key images and key words, plus branches forming a connected nodal structure" (p. 28). This technique allows the learner to draw and write the information in a form of diagrams instead of writing it in sentences, which helps the learner consolidate numerous topics in one single page. It simplifies information to help self-learning. Hanewald and Ifenthaler (2014) outlined the differences between the manual and the digital version of mind-maps. They stated that the manual mind map is easy to generate, low cost and can has a creative element to it. Whereas, the advantage of use an app such as Bubb.us (https://bubbl.us/) or other electronic software is that it does have a collaborative element to it because learners can create maps together and they can create them anytime and anywhere. They can also use them with mobiles or other digital devices (Hanewald & Ifenthaler, 2014). There are several other mapping software applications that are available freely on the internet. Some are easy to use while others have more sophisticated features. Instructors can use the manual mind map or the digital ones. Essentially, they have the same functions, but

the digital ones can be saved and distributed more easily online and shared amongst the other learners (Hanewald & Ifenthaler, 2014).

The Role of Technology in the Active Learning Classroom

As recognized in the literature, AL does not need technology for its successful application. Indeed, all the activities provided above could be carried out in a low-tech classroom. Nonetheless, technology aids in the prompt integration of these activities that would be more challenging to accomplish without it (Park & Choi, 2014; Soneral & Wyse, 2017). Technology is predominantly used to deliver information, provide examples, show learners work, give multimedia to help enhance the lesson, and distribute activities to the learners (Englund et al., 2017). The flexibility of technology helps learners use the internet to research topics of interest, send homework via email or on a learning management system, receive feedback from the instructor, and have access to the lesson slides and any material related to the lesson (Englund et al., 2017; Kirkwood & Price, 2014). Barak et al. (2006) suggest that having technology enables "hands-on problem solving and exploratory learning via the Web" and it also helps instructors give instant feedback to learners (p. 246).

Barak et al. (2006) studied the use of wireless laptops to promote AL in higher education. They looked at the behaviors or the learners, and their perceptions were regarding the use of these laptops in three consecutive semesters. Results show that they had a positive effect on learners being active in the lecture hall. Learners also perceived that laptops were most useful for preparing their homework, and helpful to have in class. In addition to the survey results, the observations revealed that the learners were more

hands-on with the activities and enjoyed working together to complete the task at hand. The technology also increased learner-centered learning.

In terms of how much technology is enough, Nicol et al. (2017) evaluated high-technology-based active learning classrooms versus a low-technology based active learning classrooms. The study took place in an organizational behavior and leadership course at the royal military college in Canada. They wanted to compare the effectiveness of two different levels of teacher-learner engagement in two different active learning environments. Two professors, who had experience teaching in an active learning environment, were evaluated. There was a total of two low tech classes, one in English with 18 students and one taught French with 19 students. Alternately, there were two high-tech active learning classes one in English with 21 students, and one in French with 16 students. The study used final grades as a measure for knowledge acquisition. The researchers also used instructor meetings, and a survey to ask students about their experiences and beliefs of using these classrooms. The results indicated that students had positive attitudes toward both the high- and low-tech active learning classrooms. Additionally, the grades showed there was no significant difference between the two classes. However, there were some barriers to using the high-tech classroom. The instructors expressed difficulties when operating these technologies and needed assistance with the high-tech active learning classroom. They concluded the study by saying that technology is available to help engage students, but it is not the central part of the active learning classroom. These results indicated the need for instructor training and professional development in the use of the environments. Other factors are also important

to the successful implementation of active learning such as learner's willingness to engage, and learner motivation, which depends on individual differences.

In addition to student gains, it is clear that there are also advantages for the instructor. The instructor will have access to all learner records and have them in the system for evaluating and grading. Technology on its own does not improve teaching, but effective integration is all about how these tools are employed (Anderson et al., 2007). Thus, effective integration of technology, active learning spaces, and pedagogics are critical in the acceptance of technology in higher education (Barak et al., 2006; Miller et al., 2000; Van Horne et al., 2012).

TEALCs and Games

TEAL is a growing movement especially in higher education. Some argue that this movement is in response to the video-game era of learners that have become more tech savvy and require more stimulus in their learning journey (McCoy et al., 2015; Ritzko & Robinson, 2006). In general, games enhance aspects of visual processing and promote self-directed learning. Depending on the activity or game, they help with intrinsically motivating learners to become better participators and results in greater learning outcomes (Burke & Smith, 2016; Premkumar & Bonnycastle, 2006). Using technology in an active-learning classroom provides flexibility and mobility. In addition, TEALCs promote better knowledge acquisition and collaborative learning. The results of a study by De Novais, Silva, and Muniz (2017) showed that 88% of learners used tablets, notebooks, spreadsheets, the internet, and the classroom itself as a way to engage in collaborative learning. In active learning, teachers are no longer teachers; rather, they are facilitators, and guides. When the activities in an active learning classroom are

interactive and have elements of technology or a gaming aspect, they allow learners to become problem solvers, collaborators, and creative inventors of their own knowledge (Beichner, 2016; Miller & Metz, 2014; Premkumar & Bonnycastle, 2006; Whitton, 2014).

Peberdy (2014) documented an evidence-based study by Dr. Lennie Scott-Webber at the Steelcase Education Solutions in 2013. Dr. Scott-Webber and her team of researchers used twelve engagement factors as an evaluation measure to document "collaboration, focus, active involvement, opportunity to engage, repeated exposure to material through multiple means, in-class feedback, real-life scenarios, ability to engage ways of learning best, physical movement, stimulation, feeling comfortable to participate, and creation of an enriching experience" (Scott-Webber, 2013, p. 13). These factors are the essential gains or aims of active learning. They researched the effect of active learning using small group collaborative tables as well as technologies in a formal education. They used an active learning post-occupancy evaluation test that was created to show impacts on learner engagement. A total of 17 instructors and 127 students were evaluated at three institutions. The results indicated that there were significant improvements in the active learning class and that there was an impact on formal learning in terms of student engagement. They concluded their study by providing recommendations for higher education policy makers to help construct these new environments that created a connection between learning behaviors and pedagogical practices.

Similarly, a study in 2015 looked at infusing educational games, simulation, and other technology-enabled active learning activities into the medical education curriculum

at a university in Arizona. Their aim was to create twenty-four interactive electronic games that were related to clinical aspects of their curriculum. They then measured the learner's satisfaction regarding this method of instruction (McCoy et al., 2015). More than 80 applications were completed using these games on a total of 550 osteopathic medical students. They created the following classroom technology-based games:

1. TurningPoint: for *pause activities and*
2. Bravo (C3 Softworks) quiz games for basic science practice
3. Prognosis-ATSU (Medical Joyworks) for *just-in-time learning* on mobile devices
4. DecisionSim (Decision Simulation) for nonlinear, VPS training scenarios (McCoy et al., 2015, p. 204).

The results of the three-year trials reflected the shift in instructional technology and the culture of the teaching faculty. In terms of instructional skills, the faculty improved as they practiced using these methods. In addition, the majority of students agreed that the games such as Bravo created an engaging layout and created a positive learning setting for them. The learners expressed that the concepts were better clarified, and clinical thinking was encouraged. They also mentioned that "scheme-inductive reasoning, peer collaboration, rubrics, feedback, skill tracking, individual vs group play, and the role of faculty" are certain ways that this gaming software helped learners engage in the content (McCoy et al., 2015, p. 207).

To add to the literature, a study in Malaysia by Abdullah et al. (2018) showed similar results to McCoy et al.'s (2015) study. They looked at gamification and active learning in a construction/building class. They looked at ways to use augmented reality and mobile learning along with technology enhanced learning (TEAL) to engage students

using five stages of learning: game elements, quizzes that are gamified, visualization using augmented reality, lectures, and discussing their opinions about the information, which is using (DGBL) digital game-based learning as supplementary materials to lecture and debrief students. The class focused on building construction and used timber construction of Malaysian traditional houses. Online student surveys revealed that TEAL was highly preferred over the traditional method of instruction and agreed that the use of games, m-learning, and augmented reality-enhanced active engagement in the classroom.

Another study by Hassan et al. (2015) investigated how TEALCs are applied among learners in technical and vocational education in a school in Malaysia. A total of 518 students participated in the study. The study focused on the delivery of lessons in different active learning activities such as in the laboratory, using simulations and hands-on activities in the Faculty of Technical and Vocational Education (FTVE). They wanted to investigate how using these activities provide students with creativity and innovation in learning. They used creative ways to present the lesson such as using animations, creative PowerPoint, films, dimensional images and multimedia.

The results indicated that TEAL had a positive effect on student creativity and innovation. These studies show comparable results to other studies that reported positive impacts of learning gains, favorable learner attitudes toward content, increased learner engagement as well as better teacher-learner interaction, and enhanced learner competencies in content areas (Baepler et al., 2016; Beichner, 2014; 2016; Brooks, 2011; Mesquita et al., 2015; Park & Choi, 2014; Van Horne, 2014). Baepler et al. (2016) established that learners in the TEALC reported being more engaged and more confident in their learning process as compared with learners in the traditional lecture.

Space Matters

Another aspect that is crucial to AL is space. Spaces that are seen as active environments provide opportunities for learners to work collaboratively and acquire higher-order thinking skills to show their understanding. The successful utilization of these technologies enhanced spaces has shown to promote learning (Beichner, 2016; Dori et al., 2007; Freeman et al., 2014; Hung, 2015; Talbert & Mor-Avi, 2018; Van Horne et al., 2012). The research regarding the implementation of AL spaces in universities has increased in recent years (Talbert & Mor-Avi, 2018). These types of spaces are designed in a roundtable manner. The tables usually have plug outlets for technology, flat screen monitors, and projectors. The atmosphere is usually a shared space where learners have easy access to instructional material to help them work together and learn (Beichner, 2014, 2016; Cotner et al., 2013; Florman, 2014; Van Horne et al., 2012). The literature also emphasizes the positive changes of upgrading traditional classrooms into more technology-infused active learning classrooms especially in higher education. For instance, these spaces help foster learner-centered instructional strategies. These include team-based learning, active participation, peer-led activities, problem-solving, and learner collaborating in higher education (Beichner, 2014; Cotner et al., 2013; Freeman et al., 2014; Park & Choi, 2014).

Van Horne et al. (2012) stated that the establishment of the technology infused TILE (Transform, Interact, Learn, and Engage) classroom at the University of Iowa focuses on providing AL spaces for learners. Other institutions have also designed ALCs such as the TEAL project at MIT (Dori & Belcher, 2005; Fisher, 2010). TEAL or the Technology Enabled Active Learning space started in the early 2000s to help

undergraduate physic learners learning complex concepts. Another includes North Carolina State University SCALE-up classrooms (Beichner, 2014). SCALE-up refers to Learner-Centered Active Learning Environments with Upside-down teaching methods. They designed their learning space in the same fashion but are more of a flipped classroom learning environment. These spaces were designed with a collaborative, technology-rich environment in mind. The initial evaluations of these spaces reported that learners had lower failures and improved critical thinking and conceptual understanding compared to the traditional lesson-type classroom. In addition to these spaces, the University of Minnesota has also conducted pilot studies on their active learning classrooms (Cotner et al., 2013).

Whiteside et al. (2010) focused on the attitudes, expectations, and views of learners and faculty regarding these spaces. The faculty had positive attitudes concerning ALCS, and many stated that their teaching roles shifted to being more of a facilitator and coach rather than a teacher or lecturer. Equally, learners generated positive comments and attitudes regarding ALCS. A noteworthy finding suggests that the average learner in this study used technology 12.9 times for a total of 50.6 minutes in their 116-minute session. This is a clear indication that technology plays an essential role in these spaces because learners rely heavily on it. Also, both learners and faculty members noticed the round-table design as being a part of changing the classroom dynamic and learning focus. Nevertheless, some learners found the room to be more useful than others. The authors related that to their year in the program and their socioeconomic level.

Similarly, in 2014, an ALC was established at a university in Korea. Park and Choi (2014) conducted a study to see the effects of this type of classroom on learners

learning. The results provided evidence that they have a “golden zone” (sitting in front of the class) and a “shadow zone” (other seats that are not directly at the front of the class) in the traditional classrooms, discriminating learners’ learning experiences because of their seating arraignments. Whereas, the ALC did not produce any discrimination because of seating. This demonstrated that the seating dynamic of the ALC space helps learners become active learners and provide them a sense of comfort in engaging in the tasks regardless of their GPA or their understanding of the topic.

Along with many other studies, Park and Choi (2014) demonstrated similar results to the implementation of these learning spaces in other studies when reporting positive impacts of learner learning gains, favorable attitudes toward content, increased learner engagement and better teacher-learner interaction (Baepler et al., 2014; Beichner, 2014; 2016; Brooks, 2011; Van Horne, 2012; Whiteside et al., 2010). Baepler et al. (2014) established that learners in the ALC reported being more engaged and confident in their learning process as compared with learners in the traditional lecture. In another study, Knight and Wood (2005) investigated the learning gains of learners in a large biology course. They compared the results of the traditional lecture to those in an interactive engagement classroom. Their study lasted two semesters, the first in the traditional format, while the second semester was in the active engagement classroom, where they added class problem-solving activities and more learner participation. Their findings reveal that learners had higher learning gains and better theoretical understanding in the interactive course and had a positive effect.

In addition, the research suggests that the construction and the design of these spaces makes a difference in learner outcomes. Learners had more learning gains when

the environment was more of a group work type of class rather than a lecture-based class (Jones & Bursens, 2015; Nicol et al., 2017; Walker et al., 2011). Talbert and Mor-Avi (2018) conducted a review of recent research on ALCs, which dated back to the introduction of "studio" classrooms and the SCALE-UP classroom until the present day. They looked at the effects ACLs have on learning gains, learner engagement, how instructors use these classrooms, and the design elements of the ACL and how it contributes to these points. They found that the studies that focused on active learning spaces showed promise in providing student gains, as in students had higher scores with the active learning classroom vs. the traditional lecture. They also found that ALCs and their overall design improved their 21st century skills such as critical thinking, social collaboration, information literacy, and creativity to name a few. Talbert & Mor-Avi (2018) also concluded that increase level of learner engagement was also a focus of these studies stating that

> ALCs tend to provoke strong improvements in student engagement, framed in terms of affective, behavioral, or cognitive forms or as a combination of these. Students typically report a preference for learning in an ALC compared to a traditional space as well as increased motivation to attend class. Students also report increased willingness to participate actively in class and to take on challenges and work past their comfort zone in an ALC versus in a traditional space. Students also report that ALCs lead to increased interaction and deepened relationships with their peers and instructors, and that ALCs foster a sense of community and belonging. (p. 28)

Indeed, learner engagement is a key goal of AL. Several studies have tackled the issue of AL spaces and learner engagement (Cotner et al., 2013; Gansemer-Topf, 2017; Sawers et al., 2016). The study by Sawers et al. (2016) investigated the effect of active learning environments coupled with a constructivist philosophy of teaching in higher education on learner engagement in order to understand how the instructors teaching approached and the space influence this engagement. The interviews and surveys of 30 instructors revealed that space has a significant impact on learner engagement when used with faculty that have a belief that learning happens when learners are actively involved in knowledge construction, therefore, it is important to prepare the instructors for these spaces in order to foster learner engagement. Therefore, the space needs to accommodate the learning goals as well as provide a realistic environment in order to engage in meaningful problem-solving activities (Nicol et al., 2017; Richardson, 2003).

However, some studies did not show positive outcomes to the ALCS. Nicol et al. (2017) researched the effectiveness of using high and low technology in active learning centers on learner's perceptions and overall grades in the Royal Military College in Canada. The 74 learners were in different classes, French and English. The results indicate that there was no difference between high and low-tech use of the classrooms. The low-tech classroom used PowerPoint and a projector, while the high-tech class used videos, group activities, and collaborative tasks. The professors found using the high-tech classroom was problematic because of the equipment and lack of training. The learners found that each type of class had some benefits, although the results showed no difference in grades. Other factors played a role in the interpretation of the results, such as lack of training, small sample size, and study design. This study is an indicator that

more studies are needed to show the effectiveness of technology coupled with an active learning environment of learner engagement, learner learning, and learner motivation. It also shows that instructors need sufficient training in Active Learning techniques and new technology to ensure maximum benefits of both.

To add, Talbert and Mor-Avi (2018) suggest that in order to create an effective ALC, it is important to keep in mind the concept of connectedness. They argue that any architectural design, simple as it may be, that promotes a sense of connectedness can provide an effective environment for active learning. They also found that mobility and freedom of movement providing proper technology as a supporting tool for activities. Prince (2004) indicated that "active learning is not the cure for all educational problems" (p. 7). Nevertheless, the benefits of this type of teaching provides a promising outlook on creating a more engaging classroom. Analyzing what works for each instructor depends on the level of the instructor's acceptance of these strategies and their technologies, the ease of using these spaces and the instructor's confidence.

Faculty Barriers and Professional Development in Active Learning

Although AL has been a "buzzword" and a topic of interest especially in higher education (Baepler et al., 2016; Fisher, 2010, 2016; Prince, 2004), there is still a gap in faculty and instructors embracing this new teaching approach, and there are several barriers to adopting it (Eickholt et al., 2018; Hall, 2002; Prince, 2004). It is important to mention the common barriers see in in the literature, including instructor misconceptions, their beliefs, environmental limitations and other influences. One of the most common obstacles mentioned in the literature is time constraints (Eickholt, 2018; Michael, 2006; 2007). A survey conducted by Eickholt et al. (2018) examined 369 faculty and 78

administrators' responses regarding the barriers of adopting AL revealed that the main barrier was time in terms of increase preparation time and limited time to carry out the different activities during the lesson. This coincides with Michael (2007) study that also mentions time as the main barrier of implementing active learning. Other obstacles mentioned in the literature are: difficulty using AL in large classes, and a lack of resources, space restrictions and the absences of technology or equipment (Eickholt et al., 2018; Michael, 2007; Niemi, 2002).

Another obstacle worth mentioning is that some faculty fear that they will lose control of the classroom due to the way the classroom is set up or the way the classroom dynamics are (Michael, 2007). This is a valid concern because ALCs are not linear. Instructors need proper training on how to manage these environments because control is not lost only distributed differently. It is important to set expectations and give clear directions for each activity given in order to gain control of the setting (Baepler et al., 2016; Bean, 2011; Eickholt et al., 2018; Michael, 2007).

As made clear in the literature, TEALCs provide engagement, increased learning gains, and interaction. The evidence shows that active learning works, however, there are challenges that arise when implementing this method. In order for active learning instruction to be successful, it requires time, training, deep understanding of the content and the activities, as well as the support of the institution. The challenges arise when implementing active teaching methods into regular lectures, into large-enrollment courses, and in classrooms with a lack of resources. In addition, the regular hour or two-hour long lectures give limited time for instructors to implement active strategies and activities. Eickholt (2018) addressed the issue of why the adoption of active learning is

minimal in higher education. The researcher also investigated the barriers of using active learning for computer science professors at public universities and colleges in the upper Midwestern United States. An electronic survey was sent to 369 faculty members and 78 administrators and support staff inquiring about their teaching styles as well as their perceived barriers to active learning. The administrator's survey was shorter and had language that focused on faculty support and difficulties regarding teaching style change. The items in the study addressed professor attitudes, professional development, lecturing, members' ability to change teaching styles, teaching styles, and the support provided by the administrators. The results showed that 42.8% of the respondents agreed that they did not have the time to improve their teaching styles. The results also indicated that the faculty members were aware of active learning and had what they needed to adopt this teaching style but needed the time and more effect to apply it. The administrators also specified that time was a problem. In addition, faculty members who received teacher training during their undergraduate or graduate studies were much more aware of active learning and also understood the dynamics more than professors that did not receive training.

Similarly, Gebre, Saroyan, and Aulls (2015) examined professor's perceptions of effective teaching in an active learning classroom. A total of 13 professors were interviewed, and 232 students were involved in the study. The study took place at a large university in Canada. During the interviews, the researchers focused on effective teaching, expected learning outcomes, instructional strategies, and the role of computers in their education. The results indicated that professors' beliefs about using technology and active learning were in line with effective teaching. Some professors viewed

technology as a tool to present and measure information as well as for student learning. The data collected from the students supported that of the professors. Also, 11 professors that used active learning in their classroom believe that their teaching has changed. However, not all professors incorporated the "strategic demands of learner-centered teaching" because of the many challenges that a professor faces in these classrooms (Gebre, Saroyan & Aulls, 2015, p. 215). Below is a table that summarizes the main challenges mentioned in the literature and possible solutions to these challenges.

Table 1

Challenges and Potential Solutions of TEALC

Specification	Challenges of implementing TEALCs	Possible Solutions
1) Time	● Not enough time to prepare (Eickholt, 2018; Miller & Metz, 2014) ● Not enough time during the class (Aksit, Niemi, & Nevgi, 2016) ● Not enough time to complete activities	● Give one or two activities during the lecture. ● Prepare before class time ● Use high- and low-tech active learning activities (Eickholt, 2018)
2) Space	● Class is a traditional lecture hall ● I do not have space for roundtable group work	● Use projects in large classrooms so they work together ● Have learners sit closer together to help promote collaboration (Brooks, 2011; Park & Choi, 2014)
3) Recourses	● Schools, universities may not have the resources to implement active learning (Aksit, Niemi, & Nevgi, 2016) ● TEALCs cost too much	● Budgeting and planning for recourse before starting the TEALCs (Peberdy, 2014) ● Providing more economical options for administrators as well as finding cost effective way to use technology (Eickholt, 2018)
4) Class size	● Large classroom sizes ● How can I make a large classroom collaborative?	● Using wireless laptops in large lecture halls (Barak, Lipson & Lerman, 2006) ● Use of clickers to promote active learning (Caldwell, 2007) ● Strategies to promote active learning in large classrooms (Allen & Tanner, 2005; Deslauriers, Schelew & Wieman, 2011; Moravec et al., 2010)
5) Course content	● Overloaded curriculum (Aksit, Niemi & Nevgi, 2016)	● Curriculum restructuring ● Revising content (De Novais, Silva & Muniz, 2017)

Table 1 continued

6) Student resistance	● Students may feel like activities are hard or a waste of time ● Some students get distracted by activities (De Novais, Silva & Muniz, 2017)	● Explain activity objective ● Give them time to complete activities ● Give choices (Khan & Pardo, 2016; Petersen & Gorman, 2014; De Novais, Silva & Muniz, 2017)
7) Teacher resistance	● Instructors feel overwhelmed by the technology (Petersen & Gorman, 2014, p. 66)	● Provide more training (Tharayil et al., 2018) ● Peer review or observation (Birdwell et al., 2016; Wieman, 2016) ● Constant administrative support (Miller & Metz, 2014)
8) Lack of training	● Support from the institution and policy makers (De Novais, Silva & Muniz, 2017)	● Training is critical when starting an TEALCs (Baepler et al., 2016; De Novais, Silva, & Muniz, 2017; Tharayil et al., 2018; Silberman & Biech, 2015) ● In service training as well as workshops throughout the academic year (Cotner et al., 2013)
9) Technical issues	● Technology glitches may occur (McCoy et al., 2015)	● Pilot the technologies before class to help fix technology bugs ● Rehearse/ practice the activity before the classroom time ● Consider using mobile technologies and apps. By training instructions to access and use games and simulations as activities to promote active learning (McCoy et al., 2015)

Based on the literature provided, the idea of using AL is not without risk. The fear that students will not participate, the notion that some might not use skills such as higher order thinking skills or a risk that they will not cover the content that needs to be met is a

concern that faculty have. Each of these concerns may be dealt with by planning, training and using best practices (Aksit et al., 2016; Baepler et al., 2016; Bean, 2011; Price, 2004). To this notion, a study conducted in Turkey that looked at how teacher education (TE) effected the way student teachers perceived active learning (Aksit et al., 2016). They found that teacher perpetration, and training is key to providing optimal results in applying active learning to the classroom. Similarly, Niemi (2002) investigated the obstacles that effected active learning use in the teacher education program and found that factors such as a lot of class preparation, the curriculum load, lack of time, classroom sizes, and lack of learning materials were the main factors that hinder the use of active learning methods. Niemi (2002) proposed better preparing teachers for active learning in their teacher education program and that having the proper training, will help facilitate the use of this method in their future teaching.

Thus, it is vital to investigate new ways of providing future faculty with training, and proper exposure to "active learning pedagogy in their undergraduate and graduate training when they may have more time and flexibility" (Eickholt et al., 2018, p. 8). These results may help in terms of preparing future instructors and faculty in higher education. It starts with faculty support, professional development and proper training (Baepler et al., 2016; Bean, 2011; Michael, 2007).

Professional Development and TEALCs

When instructors face potential challenges when teaching in an TEALC, it is important that they are prepared and trained in this area. Several authors have provided guidebooks, strategies, and recommendations to create a model for implementing technology-enabled active learning classrooms that help address the above concerns

(Baepler et al., 2016; Beichner et al., 2016; Campbell & Blair, 2018; Petersen & Gorman, 2014; Silberman & Biech, 2015; Wolff et al., 2015). For instance, Florman (2014) suggests that professional development is crucial for instructors. They need to participate in workshops that focus on active learning methods and activities such as inquiry-guided learning, team-based learning, and peer instruction. The steps of preparing instructors to teach in an active learning classroom will be addressed in brief in order to gain a better picture of how and when to use active learning.

Lesson Plans and Content Delivery

When preparing for a lecture, instructors and faculty almost always need to be prepared for high classroom numbers; they need to create lessons that combine the curricular load as well as other responsibilities, which can be burdensome (Eddy, Converse, & Wenderoth, 2015). In addition, one of the mentioned struggles is finding the time to prepare for an AL lesson. When instructors start using new strategies or activities, it is best to start with simple, low-risk activities that are well planned. These need to be based on specific learner objectives and the learners need clear instructions of the activity and why they are completing it (Baepler et al., 2016). Another way to address starting an active learning classroom is to redesign the course. In 2009, Armbruster et al. (2009) redesigned a course for introductory biology to become more active learning- and learner-centered. Although, the transformation took time and effort, they considered it a "one-time investment" because once the course was running, it did not require extra effort (Armbruster et al., 2009, p. 212). They re-designed the course by rebuilding three major parts: 1) rearrangement of the course content to teach specific themes with in the course; 2) included activities that are active and problem-based into every contact session; and 3) implemented strategies that help create a more learner-centered environment. Murthy, Lyer, and Warriem (2015) emphasized that in order for instructors to use the new strategies, they must put themselves in the learner's role. This helps instructors to understand how to explain the activity and how to ensure learner understanding. In addition, Miller and Metz (2014) argued that if instructors feel that time is an issue, content may be provided through alternate forms, such as assigning the required readings or using the internet to provide online learning. This reinforces that

students are in charge of their learning process, and that requires additional material. They also suggested that the lecture is not eliminated completely but broken down into sections instead.

In their study, they provide a guide of their interactive lesson by stating:

> The engaging lectures consisted of 10 –15 min of lecture followed by an activity that allowed students to actively apply the content to which they had just been exposed. These activities included problems or prompts that required students to brainstorm outcomes, classify components, compare/contrast pathologies, match terminology and definitions, complete case studies, solve mathematical equations, complete Venn diagrams, watch professor-designed video clips and complete worksheets, do "think-pair-share" activities, write one-minute papers, etc." (p. 247)

They calculated that in 39 contact hours, a total of 125 learning activities were carried out. This is an example of how to implement an AL lesson. However, it does not provide how to use the technologies in an efficient way.

Technology as an Enabler of Active Learning

Technology is an important element of AL. It is used to enhance and promote learning (Ertmer, 2012). For instructors who have experience using technology in the classroom, it will not take much effort to employ different apps or software into their classroom. However, it is important that novice users of technology try out the software and/or apps before introducing it into the lecture as well as receive proper training in the use of these technologies (Becker et al., 2017; Nilson, 2016). To select the most

appropriate technological learning tool for the active learning activity, it is important that instructors:

1. Review and be clear with the learner objectives in order to find the best tool (Anderson et al., 2007).
2. Try out and evaluate the technology before providing it to learners.
3. Consider the accessibility, ease of use, cost, and availability before choosing the technology.
4. Provide clear instructions for the learners as well as examples if available.
5. Find a way to assess the outcome of these tools, whether it be with a rubric or a specific learning objective.
6. Re-evaluate and verify the final technology choice and why (Campbell, 2014).

The instructional technology market is flooded with commercial gadgets, apps, and high-tech tools. Choosing the right technology can create a positive impact on student learning, especially in an active learning setting; however, it should not replace the instructional aspect of best practices (Rogers, 2000; Soneral & Wyse, 2017). Providing learners with different ways to understand the knowledge using visualization, mind maps, and tech-tools needs deliberate planning and practice. This can be as simple as using a projector or university-issued computer to more complicated software or mobile technology (Dori et al., 2003; Poellhuber, Fournier St-Laurent, & Roy, 2018; Shaw & Tan, 2015).

Feedback and Assessment

It is crucial that in TEALC, learners receive immediate feedback on their understanding of the topic during the lesson itself. During AL, the instructor pauses during the activities/lesson to check for understanding to enhance student learning and provide performance checks that align with the learning goals. The feedback can be in the form that stimulates student thinking and it may be categorized as directive, facilitative, encouraging, or neutral (Van den Bergh et al., 2014). This type of assessment is called formative assessment. Wood (2017) defines formative assessment as "a series of frequent informal contacts in which constructive feedback is provided by the teacher to the learner" (p. 60). Bransford et al. (2000) also stress that:

> The use of frequent formative assessment helps make learners' thinking visible to themselves, their peers, and their instructor. This provides feedback that can guide modification and refinement in thinking. Given the goal of learning with understanding, assessments must tap understanding rather than merely the ability to repeat facts or perform isolated skills. (p. 19)

Instructors should be prepared to provide easy ways to informally assess learner understanding and move away from traditional testing. This is because tapping into their long-term retention and critical thinking skills provides life-long learning (Baepler et al., 2014; Prince, 2004; Wood, 2017). Tests, assignments and homework are not eliminated in the active learning classroom; however, feedback is also given within each activity. This type of automatic feedback provides learners with a way to self-regulate their own learning, as well as improve motivation. Pirker, Riffnaller-Schiefer, and Gütl (2014) introduced a modal for motivational active learning (MAL), which stems from MIT's

technology-enabled active learning (TEAL) format for teaching physics. MIT provided a combination of motivational strategies and the TEAL format to provide an interactive active learning environment. They suggested a method of providing feedback in this type of environment. Table 2 is an illustration of the types of feedback and when they should be provided. Formative assessment during the active learning activity can be designed to deliver real-time feedback concerning misconceptions or gaps in learner's knowledge and understanding. MIT suggested that giving students a point system, which is a type of gamification during their activities can create positive reinforcement for learners. In addition, these strategies motivate the learners to complete their assignments. Although they are created for students in the computer science education major, when modified they can be applied to any subject matter.

Table 2

Content Types of Their Feedback Options (Perker et al., 2014)

Content Type	Feedback	Definition
Lecture Block	-	The lecture is divided into different blocks. Learning content and concepts are presented on power point slides.
Recap Quiz	Immediate	A small quiz at the beginning of each lecture about last lectures content
Concept Question	Overview statistic	Ungraded question about a new concept.
Concept Quiz	Immediate	Questions based on previous concept question.
Discussion Questions	Deferred	Peer / group discussions about new concepts / ideas / issues
Research Questions	Deferred	Internet research assignments for peers / small groups
Programming Exercises	Deferred	Programming exercises to practice learned concepts
Small Calculation Tasks	Immediate	Very small calculation tasks to practice learned concepts
Advanced Calculation Task	Deferred	More complex calculation tasks to practice learned concepts
Reflection Quiz	Immediate	A small quiz after each lecture to revise the content
Reflection Forum	Deferred	In an online forum groups should discuss last lectures' content and issues

Implications for Policy and Leadership, and Training

To date, academic learnership and faculty in higher education continue to debate the adoption of AL in their current teaching settings. Some universities have established AL centers but what is the percentage of faculty that are actually using these spaces efficiently? The question then becomes what can the administration and the policy makers do to promote new teaching approached such as AL? A professional development program that is hands-on, practical, and resourceful might be the solution to their hesitation. Policymakers who seek to promote active learning ought to invest in professional development courses that help prepare faculty for these spaces. It is essential

that in-service training be provided for current faculty as well as prepare future graduate students for their academic careers (Keengwe, 2014). Workshops, mini seminars, and ongoing professional development is key to successful adoption of active learning (Allen & Tanner, 2005; Kimonen & Nevalainen, 2005). Creating these connections will allow instructors and faculty to reflect on their teaching practices, evaluate their teaching strategies and provide new skills. The main objective of policy makers and administrators is to support student learning and faculty development. It is important to mention that change to educational reform takes time (Eickholt, 2018). If the goal of educational reform is to create a more learner-centered approach to instruction, and then providing support, resources, and training is the right pathway to implementing active learning (Silberman & Biech, 2015). Another issue that needs to be addressed is providing ongoing evaluation, peer observation, and self-reflecting within the institutions to help faculty understand theory and best practices (Wieman, 2016).

Summary and Gaps in Research

The existing literature on the AL approach, the preparation, the hindrances, and current trends all show that there is room for investigation and more research in the area. Currently, many studies are out of date, and not much has been related to faculty development. Many of the studies in this review focused on quantitative measures of student learning, however, not many qualitative studies have been conducted on the perceptions of instructors that are teaching with TEALCs. There are several studies on barriers, and on student perception and learning, however, further research is needed to show clear guidelines into how and when active strategies should be used in the classroom and how to better prepare faculty into adopting these strategies. The intent of

this study is to create a baseline of information from faculty that are already using these methods in their teaching in order to provide clear guidelines for future faculty and instructors as well as give implications for effective professional development for future and current faculty.

Conclusion

To sum up, it is clear that the implementation of TEALC is not an easy task and that not all learners or instructors involved are absolutely acceptant to the idea of this method. However, no one can deny that when implemented correctly, improved learner gains, as well as better learning outcomes, are obtained. To successfully implement TEALC, not only do the perceptions of instructors need to change, but so do the paradigms of the traditional classroom, institution, and student perceptions. The notion that having an ALC automatically means that students are active is disingenuous. Policymakers, administrators, and instructors need to be committed to change and face the challenges that may arise. Eickholt (2018) suggests a whole structural change that starts from the curriculum, assessment, professors' workload, teaching resources, training, and planning is needed for educational reform.

Chapter 3: Methods

Although technology enabled active learning classrooms (TEALCs) have been studied in the past, little research has been done regarding the practical aspects of using these spaces and the training needed for instructors on the use of the technologies available in these classrooms. The purpose of this case study is to understand why and how instructors use these spaces and technologies to facilitate active learning. In particular, this case study explored the attitudes and understandings of instructors using TEALC in their undergraduate courses, thus shedding light on ways of using these spaces and on the different teaching strategies that help create an engaging learning environment. For this research, a qualitative case study was used.

A qualitative case study is often utilized when the researcher intends to provide a deep understanding of a topic by offering a thick and detailed description (Patton, 2015). Qualitative research allows for a deep exploration of the participant's perceptions and positions regarding a phenomenon (Creswell, 2014). In addition to this, Merriam (2009) observed that providing a detailed description may "convey what a researcher has learned about a phenomenon" (p. 16).

This chapter describes the qualitative methods used in this case study, including research questions, the overall research design, a description of the participants and criteria for selection, and a description of the analysis procedure used in this study. Ethical considerations and confidentiality issues are also addressed.

Restatement of the Research Questions

The purpose of this study is to describe the perceptions of university instructors regarding effective teaching when using technology enabled active learning classrooms (TEALCs) in higher education, in all disciplines. The three primary questions are:

RQ1: How do instructors utilize TEALCs?

RQ2: What strategies do instructors employ to facilitate interactive learning?

RQ3: What are instructors' perceptions of TEALC?

Rationale for the Study

This qualitative study used a case study method to help describe the interactions between the participants, the objects, and the setting. Yin (2003; 2015) suggests that case studies can be three types: exploratory, descriptive, or explanatory. Each type can provide deep insights by researching the phenomenon to generate theories by coding pattern matching rather than testing a theory. According to Patton (2015), a case study can bring insight into a specific setting that is considered "holistic" and "context sensitive" (p. 64). Case studies are usually in-depth explorations of "individuals, groups, neighborhoods, programs, organizations, cultures, regions, or nation-states" (Patton, 2015, p. 447). Moreover, in a case study, it is essential to describe what is going on and why it is happening (Glesne, 2015). Finally, as Noor (2008) argues, a case study "is intended to focus on a particular issue, feature, or unit of analysis" and involves "investigating a specific setting" (p. 1,602). For all these reasons, a descriptive case study approach for the current research is appropriate, since this research focuses on a specific setting involving particular teaching techniques, methods, and technologies.

The reason for evaluating the teaching in a TEALCs is to provide insight into best practices of how to use these spaces. The results of this study will help provide a clear, in-depth, description of how to use technology and alternate learning (AL) spaces to help instructors teach more effectively. The space chosen for this research is comparable to other AL spaces but has distinct features that will be mentioned later in this chapter.

Considerations for Qualitative Research

In quantitative research, researchers adhere to the 'holy trinity': objectivity, validity, and reliability (Coryn, 2007; Spencer et al., 2003). Following these criteria in qualitative research, however, is difficult. Instead, researchers suggest alternative criteria for assessing qualitative research, such as credibility, dependability, transferability, trustworthiness, and generalizability (Creswell, 2002; Flick, 2009; Patton, 2015; Spencer et al., 2003). A summary of significant criteria to follow when evaluating qualitative research according to Rocco (2010):

1. The problem needs to be well articulated.
2. The study is grounded in the relevant literature on the topic.
3. The methods (data collection) are transparent, which helps ensure rigor.
4. It is essential to sufficiently explain the sampling strategies.
5. The data analysis process and the coding process are described in detail with the limitations highlighted.
6. The findings are defined and categorized, keeping in mind that each category needs sufficient data from the participants to support the theme or topic.
7. A justified discussion of the significance and implications of the research is provided.

8. Close attention is paid to organization, including headings, editing, and formatting. (pp. 375–378)

Other authors offer similar criteria for evaluating qualitative research (Creswell & Creswell, 2017; Patton, 2015; Yin, 2015). These criteria were followed when designing this research to ensure its validity and credibility.

Research Site

The study took place in a technology enabled active learning classroom at a large midwestern university. The classroom was the result of a university-wide initiative to develop state-of-the-art active learning spaces. This particular classroom opened its doors in the fall of 2014 and has since been used as a collaborative space by several colleges across the university. Important factors in this space include round or rectangular tables, personal laptops for each learner, flat screen monitors on the walls and attached to each workstation, projectors, smart boards, and whiteboards. The instructor has a workstation toward the front of the room but can move around freely in the classroom, a type of mobility that helps to promote student-centered learning (Van Horne et al., 2012). The idea is to create working pods for students to work collaboratively, while the instructor can move freely to interact with these pods.

The TEALC in this study (see Figures 3 and 4) is located at one of the university's colleges and for the purpose of anonymity will be named ALC350 classroom. This room features 135 seats and three-sided tables that seat nine per table; all tables have power outlets. Ten TV screens are mounted on the walls of the room, and six additional screens are located in the middle of the room. Three large, linked projector monitors are also available, and whiteboards are mounted on every wall. ALC350 also

contains HDMI-connectors, clickers, VGA-type connectors, and wireless microphones. Other technology tools available in the room include personal laptops, mobile devices, and iPads.

Figure 3

Arrangement of AL350 Classroom (author).

Figure 4.

Arrangement of AL350 classroom from another viewpoint (Author).

Qualitative Power Analysis and Sample Selection

The term qualitative power analysis is defined as the ability or the capacity to perform or act effectively with respect to sampling (Onwuegbuzie & Leech, 2007, p. 117). Sample size considerations are important in an attempt to capture the voice of one participant in an in-depth interview while at the same time conducting observations that typically generate a large amount of data. As Lincoln and Guba (1985) point out, obtaining a prolonged engagement with a single participant, coupled with extensive observations, aid the researcher's chances of understanding the fundamentals of a phenomenon. Onwuegbuzie and Leech (2007) argue that it is also important for researchers to be aware of previous studies of the event, phenomenon, or case under current examination, particularly with respect to the number of interviews and the length of those interviews employed by the previous research. The sample size in qualitative research is important because of the impact sample size has on the ability of researchers to generalize from their interviews. “While it is true that in many situations qualitative researchers are not interested in generalizing findings beyond the people they directly study,” generalizations are frequently made, including generalizations “from the words of key informants to the voice of the other sample members” and “from the words of sample members to those of one or more individuals not selected for the study...” (Onwuegbuzie & Leech, 2007, p. 117).

Based on the above considerations and the nearly inevitable generalizations often characteristic of qualitative research, a purposeful selection was employed for this study. Patton (2015) asserts that this type of purposeful sampling yields participants or cases that are rich in information. However, it is important to establish criteria for this type of

sampling method to ensure breadth of understanding of the topic being researched. For the objectives of this study, the following criterion was established for the selection process: all instructors needed to have had at least two semesters of experience teaching an undergraduate class in an active learning classroom environment. The class could have been in any area or academic discipline because the study looked at types of activities and not academic content. Having had at least two semesters of experience helped provide better insight because the instructors had at least two opportunities to become familiar with this teaching environment. Therefore, the researcher chose stratified purposeful sampling, which is defined as “samples within samples” wherein each branch or stratum is “fairly homogenous.” The main purpose of this type of sampling is “to capture major variations” in the phenomena being studied (Patton, 2015, p. 240). This sampling method is best used to study different ways of implementing particular teaching and learning strategies (Patton, 2015). This is also an important factor because the selection criterion was likely to provide both instructors who may have had formal training in ALC, as well as those who may not have had any formal training but are self-taught based on their experience in teaching in a technology assisted classroom.

Regarding the number of participants, Guest et al. (2006) found that 12 interviews in a homogenous group are all that are needed to reach saturation. Creswell (2014), on the other hand, advocates that four or five participants in a single study are more than sufficient. Similarly, Merriam (2009) specified that "sample selection in qualitative research is usually (but not always) nonrandom, purposeful and small" (p. 16). Based on these recommendations, this study aimed to find between 5 and 12 participants that met the criterion for the interviews and observations. These considerations also would help

with the generalizability of the study as well as the strength of the qualitative power analysis of the data (Onwuegbuzie, & Leech, 2007).

Recruitment

Protecting the confidentiality of participants is crucial. Glense (2011) stressed that "ethical considerations are inseparable from your everyday interactions with research participants and with your data" (p. 162). Therefore, researchers need to be aware of the different ethical dilemmas that they may encounter during the research, including issues of confidentiality, anonymity, and informed consent (Glense, 2015; Lichtman, 2012; Patton, 2015). To conduct the study, permission from the Institutional Review Board (IRB) was obtained. The project IRB number is 19-X-14. After that, participants were invited via email to join the investigation; the invitation included a detailed consent form stating the objectives of the study, their role, ethical considerations, and a confidentiality agreement. Participants were made aware that they had the right to opt out of the study at any time, and they retained the right to see the data collected from their observations and interviews upon request. The data collected from the interviews and the observations were stored in a secured database, with no names disclosed. Additionally, the researcher discarded the recordings of the interviews after the study had been completed to ensure confidentiality.

The researcher emailed the administration of the college and gained access to the scheduling of who was teaching in ALC350 for that semester. The researcher then proceeded to email invitations to all the instructors with the IRB number, study description, and objectives. The researcher received 15 emails, but some were excluded

because they did not fit the criteria of the study. Therefore, in the end, six instructors were eligible and willing to participate in the study.

Data Collection

Creswell and Poth (2017) propose that qualitative research should incorporate comprehensive methods of data collection and analysis to ensure in-depth results and understanding. These can be in the form of interviews, observations, documents, and audio-visual materials, which are called the matrix (Creswell & Poth, 2017). Documents and audiovisuals are essential elements of information to supplement interviews and observation. In addition, Yin (2003) argues that a case study is only successful when data analysis is based on the consideration of multiple sources. This is referred to as triangulation, which is the use of various data sources to attain a comprehensive understanding of phenomena (Patton, 2015). Moreover, triangulation helped to ensure the validity of the data (Merriam, 2009; Patton, 2015). The study employed three methods of data collection: classroom observations, instructor interviews, and document analysis. Inter-raters were also used to help triangulate the data.

Non-Participant Observations

Non-participant observations are commonly used for data collection in qualitative research. These observations made it possible to observe, analyze, and describe the impact of TEALC on student interactions and teaching practices. Observations allow researchers to record and visualize what is happening and why (Creswell & Poth, 2017; Merriam, 2009) and also help to shed light on specific behaviors, as well as identify patterns in these behaviors. The use of observations is an adequate way to elicit what is happening in the context of the phenomenon under study. To obtain rich data, it is

imperative to gather comprehensive, illustrative notes, videos, and transcriptions of a particular event that the researchers are observing (Maxwell, 2008). In addition, observations help record behaviors and interactions that may occur in a natural setting. Lewis and Ritchie (2003) maintain that observations are especially helpful when investigating the process of a particular phenomenon when the behaviors and actions of the participants are a central part of the research.

Active Learning Observation and Evaluation Tools

Although previous research has shown AL to be an effective learning method, these environments have not been effectively observed. Many observation tools to observe and evaluate ALCs, however, do exist, as discussed below. Having a standardized observation tool is a reliable way to provide insight into how these environments function, how learners interact, and how instructors perceive this instructional environment. Moreover, using a standardized observation tool can help researchers evaluate similar environments across locations to determine generalizability and usability while comparing those environments and developing conclusions regarding a range of teaching methods. This comparison can also help determine which learning strategies or technologies work best for different situations, academic levels, and programs.

Although several observation tools may be available, the researcher needs to use the tool that best suits the needs and objectives of a particular research project. In 2007, Van Amburgh et al. developed the Active Learning Inventory Tool to observe active learning teaching behaviors. The tool “was constructed to allow a trained peer observer to record the type, amount, length, and complexity of any observed active-learning teaching

behaviors" (Van Amburgh et al., 2007, p. 3). Among the behaviors observed by the instrument are: "Students participate in the lecture by responding to questions/statements via computers/wireless technology," "Students generate questions for quizzes or exams that are crafted to capture central elements of the course," and "Students [are] teaching each other basic and/or intermediate levels of course material." (p. 6) After several pilot tests and revisions, the Active Learning Inventory Tool has been shown to be "a valid and reliable tool to measure active learning in the classroom"

Similarly, Eddy et al. (2015) created and piloted an observation tool called Practical Observation Rubric to Asses Active Learning (PORTAAL). This tool provides a way to evaluate learner achievement, logic development, and other learning goals for college-level students. The researchers piloted this tool on 25 (STEM) classes. Observed behaviors include the extent to which the instructor encourages students to use prior knowledge, the amount of time students works in small groups, and the frequency with which the instructor provides praise and encouragement. The results show that PORTAAL spaces and teaching strategies promotes active learning in undergraduate STEM classes, while at the same time introducing instructors to best practices for increasing student involvement and learning.

In another attempt to create a valid scale for measuring active learning, Carr et al. (2015) modified the active learning scale in the Australasian Survey of Student Engagement by adding items that encouraged AL for online classes. The results of the study showed that those items, in fact, provided a better way to measure the amount of active learning demonstrated by students involved in distance learning and that the active

learning behavior of those students began to approach the more active learning behavior reported by on-campus students.

Finally, in 2015 Indiana University developed The Active Learning Classroom Observation Tool (ALCOT) (Birdwell et al., 2016), which was intended to help provide a comprehensive understanding of the learning taking place in a classroom. This tool was created to help gain a holistic idea about the learning experience in an alternate learning classroom. The authors took into account the technological resources available in these classrooms and created an instrument that helps faculty better understand the dynamics of these learning spaces. They piloted the tool in the spring and fall semesters of 2015 in three different TEALCs. After a total of eight observations, the developers came to the following three conclusions:

1. The Active Learning Classroom Observation Tool allowed for focused observations of the instructor's integration of the room's spatial arrangements, technologies, and pedagogies. It also served as a guide to observers' comments on the instructional choices made in the context of the space.
2. The Active Learning Classroom Observation Tool inspired conversations about teaching in all types of classrooms.
3. The Active Learning Classroom Observation Tool helped faculty developers better identify how faculty were using the active learning classroom. This perspective helped faculty developers better understand how to support the particular faculty being observed, but also rethink broader faculty development efforts (Birdwell et al., 2016, pp. 38-40).

Like all of the tools reviewed above, the Active Learning Classroom Observation Tool aims to provide a guide for researchers who want to evaluate teaching practices in the context of active learning and can be used to help elicit instructor reflections and significant feedback that can help provide guidelines, understandings, and future implications for these new learning spaces. The observation instrument that was used for this study was the Active Learning Classroom Observation Tool (ALCOT) described above. I chose this observation tool because it would help guide my research and provide explicit information regarding the ALC, teaching strategies, and instructional technology, while at the same time highlighting the observation of technologies, pedagogies, and the environment. ALCOT had already been piloted and modified to suit any discipline commonly addressed in higher education. As with most observation designs, Birdwell et al. (2016) propose using three steps when employing ALCOT: a pre-observation meeting with the instructor "to discuss the observation process, the background and goals of the instructor, and the questions for reflection that will be posed to the instructor," followed by the observation itself, and, finally, "the post-observation meeting exchange between instructor and observer" (Birdwell et al., 2016, p. 33). Appendix A contains the pre-observation questions, Appendix B contains the form used for in-class observation and contains a guide for the observer to structure the post-observation conversation. Audio recordings of all interviews and discussions with the instructor have also been used to help gather information and save the data for easy access later.

Semi-Structured Interviews

After the classroom observations, ALCOT uses a semi-structured post-observation interview. Yin (2015) explains that open-ended, face-to-face interviews are

robust, insightful, and a critical part of the data collection process. The researcher should be trained in "asking good questions" to help gather significant data for "understanding the phenomenon under study" (Merriam, 2009, p. 114). Semi-structured interviews were valuable data sources for this study because they provided an in-depth understanding of an instructor's decision-making process concerning the design and objectives of the class under observation.

Additionally, the interviews provided insight into instructors' perceptions of why they used particular technologies and how they chose certain instructional strategies. During the face-to-face interviews, the researcher asked questions focusing on teaching strategies and methods, the lesson dynamics, as well as questioning preferences and intentions regarding the technology used. The interview questions have been extracted from the ALCOT observation tool (see Appendix C).

Such questions are designed to help the researcher understand a participant's perspectives (Patton, 2015). Glesne (2015) maintains that after the main questions are asked, probing or follow-up questions generally should be used, which help elicit more in-depth thoughts and insights. Semi-structured interviews will provide deep information regarding experiences, interpretations, feelings, intentions, and opinions of instructors about their teaching (Patton, 2015; Stake, 2010). The interviews were audio-recorded and note taking was used as a method of data collection. Note taking is a tool to help the researcher gauge the interview and attend to noteworthy information that needs to be marked. It also helped create initial codes and themes. Patton (2015) suggests that these notes are best edited as soon as the interview is over while the information is still vivid.

Artifacts

When researching a phenomenon, artifacts can help foster a deeper understanding of the issue being studied. Bowen (2009) defines document analysis as "a systematic procedure for reviewing or evaluating documents—both printed and electronic" (p. 27) and helps with eliciting meaning and developing empirical knowledge of the physical documents (Bowen, 2009; Silverman, 2001). Several types of documents can be collected (Bowen, 2009; O'Leary, 2014), including meeting minutes, memos, emails, and other documents commonly used in the workplace. Relevant documents can provide important insights into how and why instructors teach in a certain way. Also, documents help triangulate certain information from the observations and the interviews by making connections with the data. Bowen (2009) argues that documents are non-reactive sources of data, which means that they can be studied and restudied multiple times to help the researcher understand the big picture. Artifacts are also considered objective data because the researcher takes the artifacts as they are and does not alter them in any way (Merriam, 2009).

For this research, lesson plans, student worksheets, and classroom material were important artifacts that helped provide additional data about the active learning process, the planning that was done to prepare the lesson, and the student activities intended for the class. In total 15 different artifacts were collected in total during this research.

Role of the Researcher

A qualitative researcher is considered the main instrument for both the data collection and the data analysis process (Merriam, 2009; Patton, 2015). Personal history and the background of the researcher are also essential parts of decoding the data because these reflections can provide valuable insights into the case study being researched (Creswell, 2013; Yin, 2015). The researcher's primary role in this study was to interview the instructors, observe the interactions in the TEALC, and examine the data collected from the observations, interviews, and artifacts. At the time of this study, the researcher had been an elementary educator for five years and an educator in higher education for four years. This educational knowledge and experience gave additional perspective to the data collection and analysis process, as the researcher understands the dynamics of a classroom, methods of teaching, and teacher-student interactions. The researcher is considered an advocate of AL in the classroom and has had experience facilitating active learning in the past. The researcher has also had extensive experience with using technology in a higher education setting and therefore can relate to the study's participants. It is also important to note that data collected is based on the observation and interpretation of the researcher; therefore, if the researcher is biased, this will affect the data collection process and the analysis process may influence the outcomes (Merriam, 2009). This bias may be controlled by conducting a peer review or inter-rater reliability checking of the data, which is when a fellow researcher or a peer, checks the data collection process and the analysis of the information to see if the interpretations are clear and consistent (Creswell, 2014; Patton, 2015).

Trustworthiness

Trustworthiness in qualitative research indicates the degree of confidence in data collected, the interpretation, and the methods used to ensure the quality of a research (Shenton, 2004). Adding to the trustworthiness of the study, the instructors had varying degrees of experience and expertise in teaching in a technology assisted classroom and came from a wide range of disciplines. The study was not limited based on gender or age. Because of these factors, it should be possible to duplicate this study in other contexts. The study was strengthened by the triangulation of data sources from the observations, document analysis, and interviews, which helped ensure the credibility of the research (Patton, 2015).

Assumptions

Three assumptions were made for this research. First, the researcher assumed that a sufficient number of instructors would be willing to volunteer to participate in the study, which of course proved to be correct. Second, the researcher assumed that the participants in the study would be honest and candid with their responses during the interview process while understanding at the same time that some might have been reluctant to answer personal questions or discuss specific topics. Finally, the researcher assumed that the instructors would be comfortable during the observation process and that the data collected would, therefore, be an accurate representation of their normal teaching behavior.

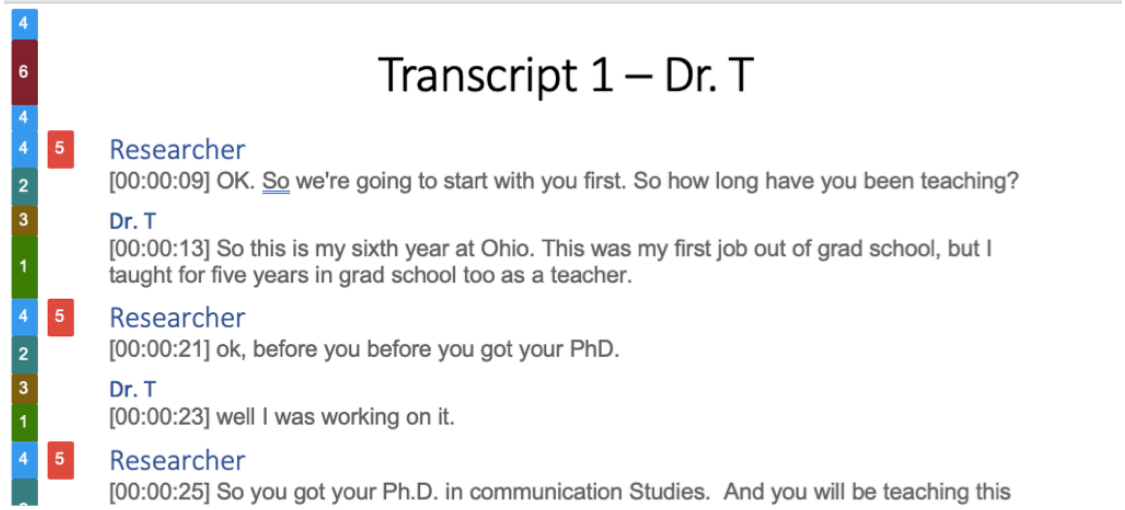
Data Analysis

Data analysis is vital in determining the quality of the research. The process should be described in detail to ensure the trustworthiness of the results and the research

process (Yin, 2015). Creswell (2014) suggests three steps when analyzing the data: organizing, making connections, and coding all the data. The researcher began the process of data analysis by first transcribing all the interviews using a third-party provider. The recordings were deleted after completing the transcriptions. Each interview was about 35-40 minutes long. The researcher then began to read and re-read the transcripts, and notes in Microsoft word in order to get them format ready for the Nvivo 12 for Mac software. This process was time-consuming because all the documents needed to be formatted in the same formatting sequence. Figure 5 shows the formatting process of all the interviews before entering them into Nvivo, which helped generate codes, auto code data, create word webs, and so on.

Figure 5

Recording Process

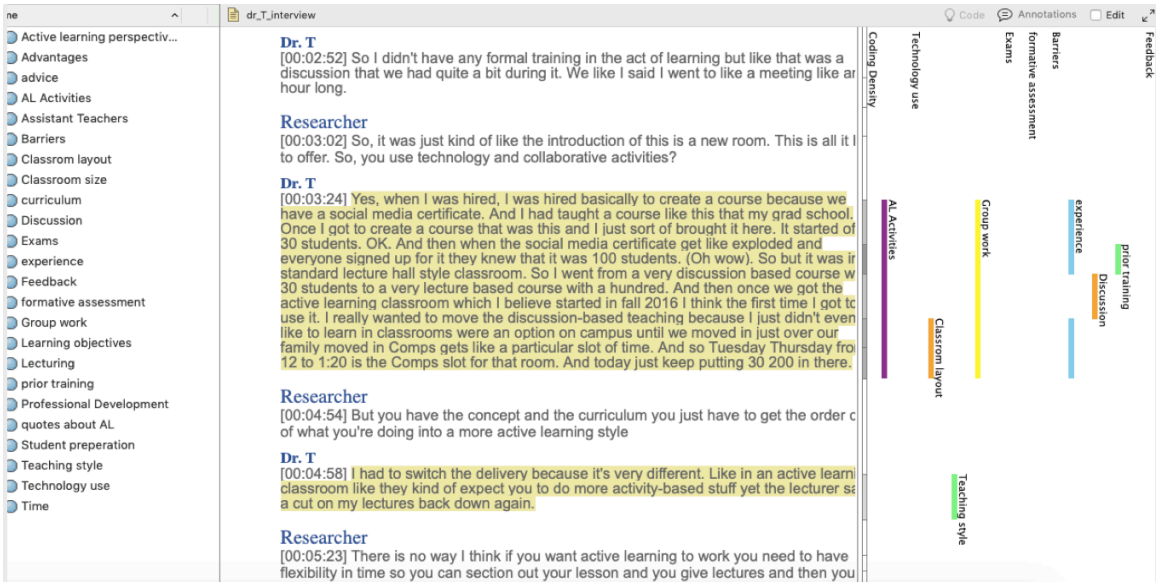


After that, the researcher began to type notes from the observations into one document. The researcher also typed all the observation details into the observation tool. Then, the researcher scanned and uploaded all the images and artifacts on the researcher's laptop. The researcher then imported all the data into Nvivo 12, followed by data coding. Creswell (2014) suggests that there should be no more than 25 to 30 codes for the first round of coding. The researcher conducted the interviews first and began to generate themes as the researcher read the interviews. Initially, there were 27 nodes or codes. Some codes were developed based on previous literature, such "as barriers to adoption of TEALC," while other nodes were emergent from the data itself. Examples of the primary codes/nodes that were developed based on the interviews, observations, and artifacts during the initial coding process are illustrated in Figure 6 below. As shown, the bullet points on the left are the initial nodes created before subcategories and associations were

applied. The different highlighted color-coded nodes on the right represent where in the text these nodes occur.

Figure 6

Thematic Nodes Created on Nvivo for Mac for Qualitative Analysis



To analyze the data further into manageable units, the researcher then began to create sub-categories, consolidating them into major and minor codes depending on frequency and correlation to the research questions. The researcher then ran various cross tabs, frequency searches, and text queries and created the final coding list:

1. Adoption Barriers
    - Technology Failure
    - Time
    - Classroom Size as a Drawback

- Classroom Layout Limitations

2. TEALC factors of adoption
    - Teaching assistant/ Student teaching assistant use
    - Teaching style
    - Technology familiarity
    - Technology for delivery of content
    - Technology for collaboration and discussion
    - Trial and Error
    - Classroom design
3. Professional development and training
    - Peer observation
    - Online PD
    - Prior training
4. Perceptions of TEALCS
5. TEALC Activities and Strategies

The final step was to compile all data from examples, quotes, figures, artifacts, and observation notes to address the research questions. The major themes aimed to provide a comprehensible, concise, and coherent representation of the instructors and their perceptions of and attitudes toward TEALCs.

Chapter Four: Results

This chapter includes the results and main findings of this research. The purpose of this research was to understand participants' utilization of technology, teaching methods, and perceptions toward teaching in a technology enabled active learning classroom (TEALC) at the university level. Data were collected through semi-structured interviews, classroom observation, and artifact analysis. During the interviews, the six instructors participating in the study shared their experiences, perceptions, attitudes, and motivations for instruction in a TEALC. The researcher supplemented these interviews with classroom observation, which gave a more in-depth look into how instructors utilized the AL space in terms of design, use of technology, and classroom activities. Interviews were conducted with all six participants, and the classroom teaching of four of the participants was observed, as two instructors declined the observation.

Description of Participants

Six instructors participated in the study and held a variety of academic ranks. Several had many years of teaching experience while others much less. All held one or more advanced degrees in their disciplines, which were generally, but not exclusively, in the social sciences. Experience in teaching in a TEALC ranged from several years to only a few semesters. See Table 3 for a summary of participant demographics. The instructors have had experience teaching in an AL type classroom previously. The spaces may differ from the TEALC that is examine in this study.

Table 3

Participant Demographics

Instructor Alias	Gender	Titles	Teaching experience	Discipline	Semesters in TEALC
1. Instructor A	Male	Professor	30 years	Communications: Rhetoric, Place, and Space; Public Memory	5 years
2. Instructor J	Male	Associate Professor	9 years	Graphic design and media literacy	3 years
3. Instructor K	Male	Lecturer	25 years	Finance	2 semesters
4. Instructor M	Female	Assistant Professor	8 years	Gender and American Religion	2 years
5. Instructor R	Male	Lecturer	17 years	Journalism	2 semesters
6. Instructor T	Female	Assistant Professor	5 years	Interpersonal Communication; New Media	4 years

For the most part, the instructors chose to teach in these spaces. Only one instructor was required to teach in the TEALCs. He did not choose to teach but adapted to the space. For this study, only four instructors were observed because two Instructors, J and R, opted out of the observation. The observations lasted around one hour and twenty minutes. After each observation, a post-class interview was conducted. Each interview took between 35 and 45 minutes. The researcher took observation notes during the classes using the Active Learning Classroom Observation Tool (ALCOT) discussed in the previous chapter and made reflective notes after the observations and post-class interviews.

Findings Related to Research Question One

This section details the main findings related to research question one: "How do instructors utilize TEALCs?" This question investigated the instructor's utilization of the TEALC's space capabilities and each instructor's use of technology and active learning activities. To address this research question, analysis of the data gathered from the observations and interviews helped provide a clear image of these issues. The researcher observed the classes of four of the participants (A, T, M, and K). Although many similarities and differences were observed between the instructors, they all involved the technology employed, the types of classroom activities, and the use of the space. During the analysis of the observations and interviews, specific patterns emerged. The first pattern the researcher refers to as the TEALC Factors of Adoption. The main themes related to this pattern were technology use, teaching style and observation, classroom design, and use of teaching assistants and student teaching assistants.

Technology Use

This study defines technology as any hardware and software that is used and available in the ALC350 as well as other technologies not directly tied to the classroom, including online applications, email, PowerPoint, and Learning Management Systems (LMS). In general, all the instructors had their course material available on Blackboard or online and communicated with students through Blackboard and email. Also, all instructors had their course descriptions, syllabi, handouts, and grades on an LMS system such as Blackboard Learn or Google Classroom. All instructors used the various available technologies in the room to present their content, including PowerPoint, videos, and the LCD TVs.

All the instructors in this study reported that integrating technology into an active learning classroom is beneficial but has its flaws. They all agreed that having technology that is easy to use, easily accessible, and free of error helps them deliver content, facilitates activities, and promotes group work. According to Instructor J, "technology facilitates your teaching but only to a certain extent." This is because he believes that using technology in an ALC is essential but should not be the main focus of the class. He also mentioned that technology use depends on the way the instructor teaches, the flexibility of the curriculum, and the students themselves. All instructors used the central podium and workstation toward the front of the classroom, PowerPoint to present content on the room's large screens, the LED screens, and their personal laptops. None of the instructors used the built-in microphones, indicating that their voices were loud enough for all the students to hear.

Different instructors made different uses of the technology. For instance, Instructor A and Instructor T presented the work of their students on the big screens using the central control hub and were familiar with how to link and unlink students' screens. Instructor A also linked students' notes and provided feedback to each group. Instructor M, on the other hand, used the small screens next to each group but moved around to each group and read from the screens instead of showing a student's work on the big projector screen. Not all instructors used the clicker provided by the room's support staff, since they need to be booked in advance. Instructor M, Instructor T, and Instructor A used their personal clickers, while Instructor K did not use one. Below is a summary of the technology observed and which instructor used which technology:

Table 4

Summary of the Technology Tools Used During the Observations

Technology Tool	Instructor A	Instructor T	Instructor M	Instructor K
Big screens (main projectors)	Y	Y	Y	Y
Built in microphones	N	N	N	N
Camera	N	N	N	N
Clickers	Y	Y	Y	N
Course website (LMS)	Y	Y	Y	Y
Excel Sheet	N	N	N	Y
Lecture slides (PowerPoint)	Y	Y	Y	Y
Main podium/ work station	Y	Y	Y	Y
Multiple sources of Media	Y	Y	Y	Y
Personal laptops/ BYOD	Y	Y	Y	Y
Student BYOD	Y	Y	Y	Y
Social media	Y	Y	N	N
Videos Ex. YouTube	Y	Y	N	N
Wall mounted Numbered Scre	Y	Y	Y	Y

Notes. "Y" indicates that the technology was used, whereas "N" indicates that it was not used during the observation.

Main Control Podium

TEALCs are designed with students in mind. The technology is provided in the classroom to help instructors teach and students learn. The instructors all felt that having technology in the room was a benefit to their teaching, especially for the delivery of content. All the instructors used the main podium, which is the hub for all the technology in the room, to facilitate the multi-display of the different equipment, and all indicated that the podium was useful and somewhat easy to manage. Instructor A connected all the screens to the overhead projector, as did Instructor T. Instructor J commented that the podium was a great way to see all the controls at once. All the instructors hooked up their personal laptops to the podium instead of using the one provided in the classroom. As Instructor K explained:

> The reason for that is because I'm not a Mac guy you know. It's the mouse it works different on Apple products and I just kind of grew up the other way. Yes, so you know I would need a couple of weeks to figure out just the idiosyncrasies of opposing them and you know that's why what I do I love that Crestron system right where I can just yes, I can connect via Wi-Fi and drive it from my personal laptop.

Instructors M, T, and A used the podium to show student work. All instructors used the podium to present videos, presentations, articles, and other materials.

Numbered Screens for Broadcasting

The wall-mounted screens are considered crucial parts of the TEALC. Each table has a designated screen and number. The numbers make connecting the screens easier to the main projector. Both the students in each group and the instructor could control the

screens. One instructor used these screens to display notes from one student in each group, while another instructor had directions on some screens and reading material on others. Instructor A linked and unlinked these screens during discussions from each table. Instructor K used the screens to provide different mathematical questions and used the main overhead projector to answer the questions. Instructor T showed another use of these screens by displaying three different stories distributed across all the screens. Instructor M enjoyed the fact that an instructor could control these screens, shut off the screens, and even bounce between them but said it took most students a few trials before they understood how to use the screens. They now feel at ease with linking their personal laptops and showcasing their work.

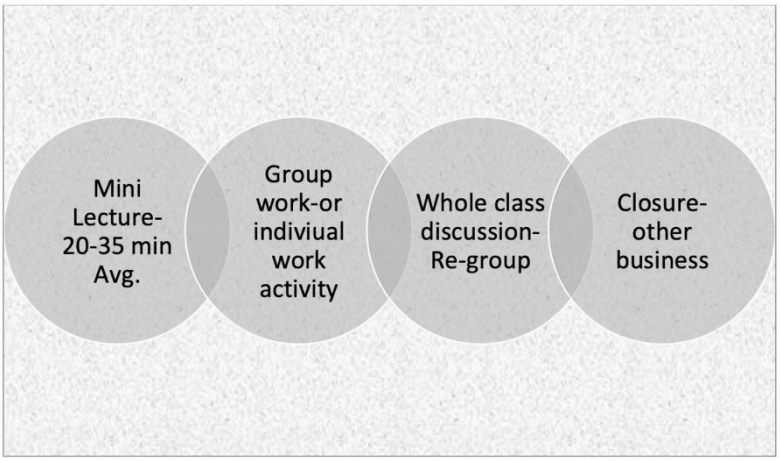
Teaching Style and Observation

A noteworthy finding is that all instructors had a similar process for delivering content, as shown in Figure 7. This indicates that all the instructors in the study preferred to start their class by lecturing and then moving on to a group activity. The class would then reconvene as a whole to discuss the findings of the groups and give students a chance to ask questions. Finally, all instructors ended their classes by discussing the preparation needed for the next class and reviewed future exams and project due dates. The data shows that all classes used some form of group discussion. Instructor A used the group work to review theories, summarize the topic, and engage in debate; Instructor T used group work in the same manner, using the small groups to complete planned activities. Other instructors used a mini activity at the end or at the beginning of the class or had a slightly different approach to group work. For example, Instructor K had

students work on mathematical problems in pairs, and then reviewed the answers as a whole class.

Figure 7

Structure of Content Delivery



The observations also indicate that the instructors preferred small group discussion activities as the primary type of AL strategy. Working in groups was a way for teachers to promote interaction between the students, share experiences, complete tasks and projects, and promote collaboration. Instructor K used more individual activities than the others due to the nature of the class and the mathematical material presented. His class includes more individual learning because it is mostly mathematical. Therefore, they students usually work alone. Instructor A used the technology to help reinforce learned concepts and theories by putting them up on the screens during group activity time. Instructor M used the groups to provide meaningful discussions regarding

controversial topics, while Instructor T often provided students with worksheets to guide them in their discussions.

Classroom Observation for Instructor A

As the researcher entered Instructor A's class, all 80 students were seated at nine tables near the podium at the front of the classroom. Four students used notebooks, while the rest used laptops or iPads. Instructor A taught the class using a structure similar to that shown in Figure 7 above. The class began at 3pm, with a 20-minute lecture using the main screen to present an outline of the lecture. It was clear that the students had prior knowledge of the topic. The instructor walked around the middle part of the lecture room while explaining the theories and seemed very comfortable with the physical layout. After the lecture was over, the instructor went back to the main podium and linked the screens around the room with a case study. At each table one student had a laptop linked to the middle or side screens, which mirrored the laptop, as shown in Figure 9

Figure 8

Mounted TV Screens with Activity

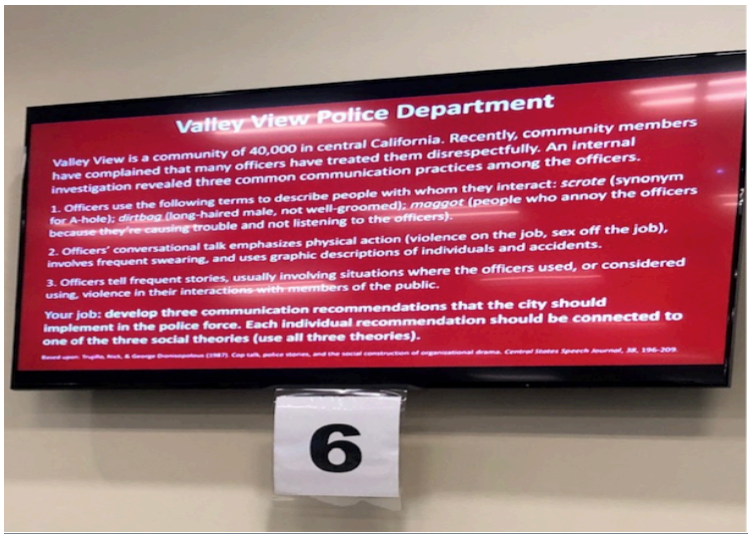
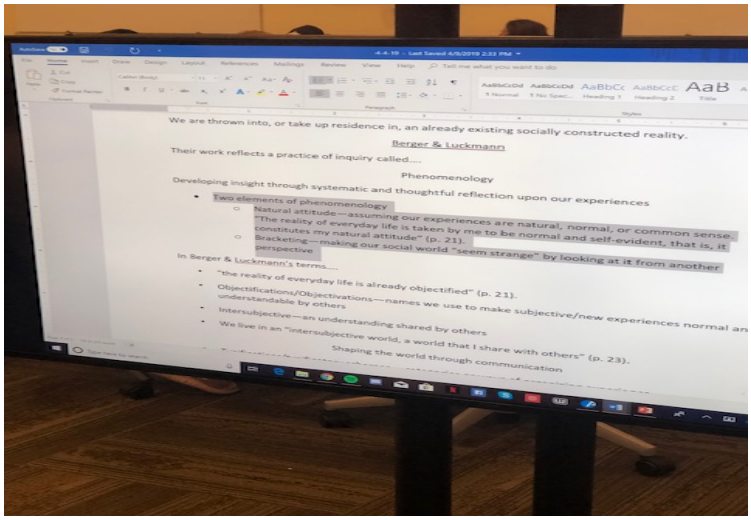


Figure 9

Mirrored Student Work on Middle Screens



The activity took about 35 minutes. One student served as note taker and typed information that showed up on the screens next to that group as shown above. Students discussed each theory and wrote their recommendations on their screens. A total of three scenarios were distributed between the nine tables. Students knew which screen to look either the large screens or the screens near their table. The groups were obviously familiar with this type of activity and quickly began the assignment. After the activity, the instructor regrouped the class, pulled up each screen, discussed some of the results, provided feedback, and encouraged the whole class to participate in the discussion of the results of each group. This lasted until near the end of the scheduled class time. A student teaching assistant then distributed a peer evaluation form that allows students to evaluate the other members of their groups. Instructor A ended the class by answering student questions on upcoming exams and projects.

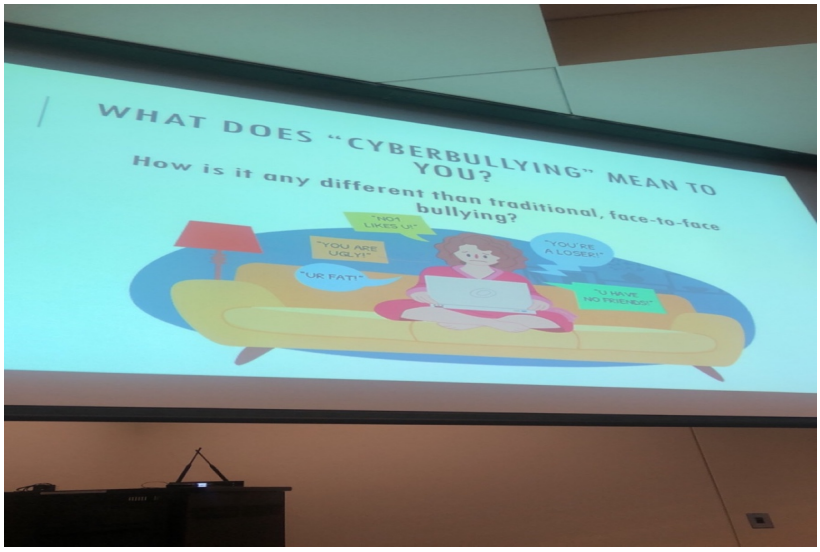
In analytical reflections on the class, the researcher noted that Instructor A's energetic manner appeared to motivate the students and that they seemed interested in the topic. Most of the students used personal laptops, while one student in each group had a laptop linked to a numbered screen. After the initial 20-minute lecture, the class was very actively structured. Instructor A used case studies, real life problems and challenges that helped students relate to the class content. Student TAs made sure that all the other students were on task. Instructor A was very familiar with the main control system, was obviously at ease linking and unlinking screens, and was comfortable with the physical layout of the classroom. [Date of entry March 11th, 2019]

Classroom Observation for Instructor T

Instructor T began class at 12:00pm with a 5-minute quiz before moving on to the structure shown in Figure 10. (During the interview Instructor T indicated that pop quizzes were used from time to time but were not a standard part of the class structure.) The instructor then went on to introduce the main concepts of the lesson in a short lecture while giving the three TAs assigned to the class folders to give to each group. Each folder contained all the questions, worksheets, case studies, and instructions required for that class session.

Figure 10

PowerPoint Presentation on Overhead Projectors



A total of 120 students were present in the class. The folders were distributed in such a way that four tables got the same news story on the topic of the class session. The instructor then asked students questions to ensure their understanding of the assignment,

followed by a 3-minute video. Instructor T then posed a series of questions, which the students discussed at their tables before addressing the questions as a whole class. This entire activity started at 12:40 and continued until the end of the scheduled class time.

The students worked together on each story in their group, attempting to discover the cause of the problem reported in their assigned stories and determining how such events might be prevented in the future. The students were obviously very engaged and even concerned about the effect of social media on young people. Both the TAs and the instructor circulated around the room to make sure the groups were all on task. Students were writing notes, comparing ideas, and establishing positions on each story. The class design provided enough time to work on the stories and the students did not seem rushed. One student in each group was linked to a screen to show their group's notes on each account. Instructor T provided feedback on each story, gave each group a few minutes to discuss the feedback, and then ended the class by noting projects and due dates.

In analytical reflections on the class, the researcher noted the highly interactive nature of Instructor T's teaching, which the researcher described as energetic and passionate. The students were very interested and engaged, obviously knew what to do and stayed on task. Instructor T was organized and used a folder to keep all documents together, thus eliminating any confusion students might have. When one student asked about the next step, another student at that table just opened the folder and said, "We have to answer these questions on each story." Students appeared free to tweet about the lecture, write on social media, and use their personal smart phones and laptops but did not seem distracted by the use of their personal devices, instead using them to research the stories and find information relevant to the class content. Although this class had 120

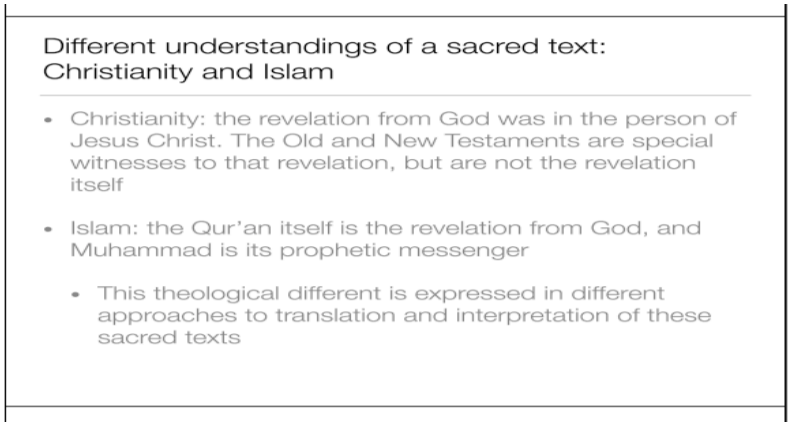
students, the room did not feel all that crowded. The students all knew their roles, and the TAs and instructor made sure that they were working well together. Because of the contemporary nature of the topic, students were highly engaged. The instructor utilized the technology well and was confident in using the screens, overhead projectors and individual screens. Overall, the class was very active and engaged. [Date of entry March 5th, 2019]

Classroom Observation for Instructor M

The lecture started precisely at nine in the morning and lasted for 20 minutes. The students were interested and attentive throughout and began immediately taking notes when the lecture began. The instructor moved around the room during the lecture, asked occasional questions and provided time for students to respond. Because the content of the lecture was quite controversial students were very attentive and actively taking notes on their laptops. The lecture was accompanied by PowerPoint slides, which were on both the big screens and those located at each table. Figure 11 shows one of the instructor's slides on the topic.

Figure 11

PowerPoint Slide for Instructor M



After the opening 20-minute lecture, Instructor M gave instructions and prompts for the group discussions, which lasted until the end of the class. The class was organized into four groups, with approximately 10 to 15 students in each group, which required the moving of chairs to each of four tables (apparently, according to the instructor, several students were absent and the students remaining in those groups needed to join other groups). Student TAs led three of the group discussions, while the instructor let the fourth group because the group's TA was one of the absent students.

The following is the first activity the groups engaged in:

- Read the Genesis account of Lot (Lut) with your quiz team
- What do you think the story is about? What lesson(s) do you think that communities that hold this text sacred should take from this text?
- Imagine with your team that you are devising a policy of sexual ethics for the state of Ohio, using this text as a guideline. (Sexual ethics could include anything

from policies about sex education, marriage laws, laws on sexual assault and harassment, etc.) Be as creative as you like—there are no "right answers."

- What policies would you come up with? Do you find the perspective of either Kugle or Ali on how to engage with sacred texts helpful in your policymaking? Why or why not?
- Write these down! You'll share them with your dialogue groups.

This activity took about 30 minutes, during which students recorded their thoughts and policies on their laptops, followed by an active discussion led by the TAs. The researcher moved around each discussion table to get a sense of their interactions and all were focused and engaged. At the end of the 30 minutes, Instructor M debriefed each group, discussed their ideas, and provided feedback.

The second activity, which was called dialogue groups, was as follows:

- What did your quiz team think the story of Lot (Lut) was about? How/why did you come to the conclusion that you arrived at?
- What public policies did you come up with your quiz teams? Did you find this exercise challenging or surprising? Why or why not?
- Many countries that are influenced by Islamic jurisprudence legally forbid same-sex relationships. What do you think is the role of self-identified progressive Muslims in changing or reforming these laws? How involved do you think people from other countries and regions of the world should be in those reforms?

The discussion of each of these points took the remainder of the class. Instructor M was again circulating around the room, listening to the answers of the students, encouraging deeper dialogues, and challenging students to think deeply about the topic.

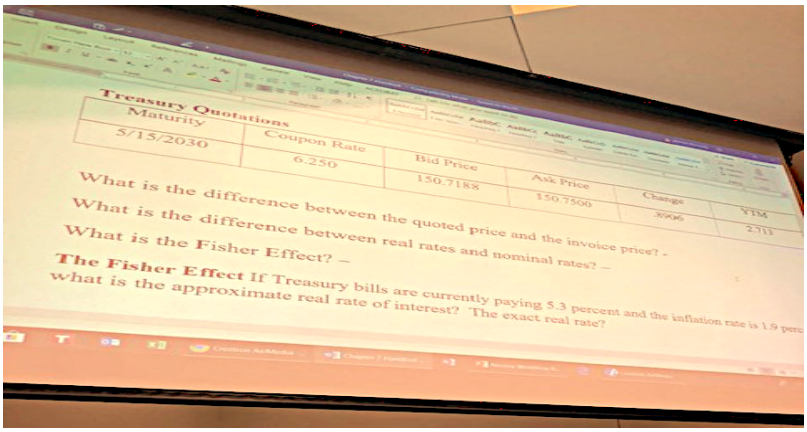
In the analytical reflections on the class, the researcher noted that Instructor M seemed very comfortable using the technical and physical resources of the classroom, knew how to work the system, and was familiar with the space. The lecture seemed to have been well prepared and was delivered with confidence. The use of PowerPoint on the large overhead projector gave the students a visual aid that allowed them to follow the lecture. Even though some students did not face the instructor directly, they all were attentive and actively writing notes during the lecture. The large number of students, around 60 students, did not seem to hamper the lecture, nor did it affect group dynamics. The class was well organized and, for the most part, the students stayed on task, although some side conversations did take place from time to time. The students did not seem distracted by my presence. During the discussions, the researcher sat for a few minutes with each group to get a feel of their discussion dynamics and how they were completing the task. One group involved me in the conversation and asked my opinion on the topic. The researcher asked the professor if they could answer the question, and, receiving permission, explained my point of view. The students were interested in what the researcher had to say and asked a few more questions before they moved on to the other groups. The students seemed well prepared, although the instructor did mention in the interview that it had taken a while for the students to get into the routine of these types of activities. [Date of entry March 21st, 2019.]

Classroom Observation for Instructor K

The class, the content of which was more technical than the others I observed, began promptly at 11 am. The class was more mechanical because of all the mathematical equations. Each student had their own individual work. The steps to finding the answer is usually done individual. They discuss the answer together after. Forty students were enrolled in the class, but almost half of the students were absent. In the post-class interview, the instructor had explained that credit is not given for attendance, so students had the flexibility of using online lecture notes, completing the problems online, and submitting them via Blackboard. Before the lecture began, the instructor reviewed the quiz questions. The first part of the class was mostly spent with the instructor discussing the day's topic, explaining some concepts, showing a few technical methods, and providing students with a real-life situation, possible problems, and possible solutions. The instructor then gave the students several problems and went through each solution step by step, as shown in Figure 12. Instructor K made several recommendations for real world issues a student might face using the issues discussed in the class. Students were engaged and attentive throughout, taking notes and asking questions as needed. The instructor used a PowerPoint presentation on the big overhead screen, while another screen had an excel sheet showing relevant equations.

Figure 12

Instructor K's Mathematical Problems



The student used whiteboards and laptops to answer questions that were put on the overhead projector (big screen). After each problem was worked on individually, Instructor K responded using the help of a student every time. He explained mistakes and completed problems using the excel sheet. He gave feedback and frequently asked students to complete the task with him on the screen as he answered the problem. The class ended with the instructor reviewing various administrative details.

In analytical reflections on the class, the researcher noted that the class was very straightforward, business-like and focused on the content. The primary communication pattern was between the instructor and the students, individually and with the class as a whole; there was very little interaction between the students. Students were attentive, although some became confused during the problem solving. They instructor needed to explain each problem after each was solved. Because of the mathematical nature of the lecture, there was not much room for activities or active learning. Although Instructor K

did give the students time to discuss each problem, this was not group work per se but more a way of making sure they all had the right answers. Since the instructor did not really use the technology or physical resources of the room, the lecture could well have been presented in a regular lecture room. [Date of entry: 20th March 2019]

Classroom Design

The classroom design played a role in how the instructors taught in ALC350. To be successful in such a space, an instructor needs to be comfortable with the physical layout of the room and have the students sitting in a way that they can all benefit from the class arrangement. All of the instructors in the study discussed those aspects of the classroom design that they liked and did not like. The majority stated that the tables are extremely beneficial in promoting group work, student engagements, and classroom debates. The instructors were all comfortable using the central podium, indicating that it was easy to use and in a central location. Instructor A was initially very impressed with the design and eager to try out the features, changing teaching strategies to become more active and trying different ones to see which were most effective. Instructor R liked the room because it promotes student engagement, suggesting that this is how students will work in their jobs once they graduate:

> This class, the students work together as if they were in a workplace. We're in a newsroom. And so, like they'll be bouncing like you know what you think of this headline or what's a better word for or you know what's AP style. This constant back and forth. To make when they're using design. So, what do we have put a picture and stuff and so there's a lot more in-game interaction and then I'm

> floating around. Because they get to work on their own individual project. So, they're getting individualized instruction.

Instructor J, who had been teaching in an ALC for several years, had developed a more active teaching style as a consequence of the classroom design, walking around more than in a traditional classroom, pointing out that the room is set up in a way that helps instructors move freely among the students. This same instructor stressed that group work is important, but, in some cases, wondered what might really be happening in the groups but felt that it is essential that all students participate: "So, unlike the lecture hall, I can move around. I can know if there are people who are not doing something else or who I think have something to say." Another instructor mentioned the same point by stating:

> When I'm doing a lecture, I will go down the middle and stop at various points throughout the room. I walk around a lot. I mean if I stay in one place, I'm always speaking to the back of some students [although] they might be able to look at a screen. That's kind of an odd thing to be looking at a screen and hearing the voice. I try to move along that center walkway catching the screen. And when they're doing group activities while I circulate around just to see what folks are doing.

This same instructor stated that the configuration of the room provides a way to be more flexible. "So, the major difference that the active learning classroom gives me more ways to interact with my class. So, it gives you more freedom to move in the space to reorganize the space. That gives you a lot of flexibility."

Instructor T talked about how the ALC350 helped develop a connection with the students and used a more flexible teaching style to suit the new classroom in an attempt

to create more activities that fit the way the class was set up, which meant more group work activities and fewer activities in which students worked on their own. “I had to switch the delivery because it’s very different. Like in an active learning classroom like they kind of expect you to do more activity-based stuff.”

Two of the instructors felt that the triangular tables helped facilitate small group discussions, creative work, and working in pairs, thus creating a motivating atmosphere for students, who would be less intimidated than by a traditional lecture hall because they would be working in teams. Instructor R said that:

> The tables are these triangular tables that seat nine people total. Three people on a side. So, it’s a great setup for small group discussion. It would be a great room for a large section that was focused more on team-based types of projects.

Support: Teaching Assistants/Student Teaching Assistants

During the interviews, it was clear that all instructors felt that having some sort of support helps teaching in an ALC. In most cases, they mentioned that large classes are hard to manage alone, but when a TA or an STA was available, it made a big difference in how they delivered content, facilitated activities, and administered exams. All acknowledged that classroom management, though possible, is difficult with big numbers. Instructor A had to make do with STAs; because of budget cuts the university did not allocate TAs for his class, in spite of its large size, stressing that STAs were essential in creating a manageable classroom when it is a larger classroom. The STAs in this instructor’s class received extra credit for being group leaders. This instructor felt that STAs were essential for classes over 100 and even uses them in a 400-student lecture hall. These STAs are usually students that have completed the course but are still

majoring in the same area and need extra credit. They are in charge of leading discussions at each table; they make sure students are on task, that students complete their projects and provide students with information on exams, dues dates, and overall help students with their progress through the course.

Instructors M and T mentioned that using TAs is a great way to facilitate group work, help with classroom management, and administer examinations. Instructor M had three students TAs in the class observed in this study and felt that the extra support provides assistance when needed. Because Instructor M's class is dialogue-based, having TAs helps with student engagement. Finally, Instructor T noted that, "I have two TAs, and then, I also have group leaders and folders for the tables. So, if I need to give them something, they know where. And they'll often have their activities in the folder." All the instructors felt that TAs provided considerable benefits for supporting student learning and instructors in the ALC350.

Two of the instructors, J and K, did not have the luxury of having TAs or STAs and both expressed the difficulties of managing large classes. Instructor K acknowledged that it is hard to make sure everyone is on task when a class is too big, while Instructor J felt that having TAs might help but has not yet used them.

Findings Related to Research Question Two

This section details the main findings related to question two: "What strategies do instructors employ to facilitate interactive learning?" This question investigated what activities and interactive strategies help promote active learning in these technologies enhanced classrooms. All four instructors observed used activities such as small group work, debate, whole classroom discussions, and individual activities.

Discussion and Group Activities

After analyzing the artifacts, it was clear that different instructors preferred different types of activities. Instructor T provided many examples of activities during the classroom lecture time that would be considered being active, explaining that a simple PowerPoint with blanks is a great way to get students active, get them motivated to find the answers, and provide them with a way to review information.

> I give them like an incomplete PowerPoint posted on Blackboard that they can fill in. And I coach them through and say look when you are listening there are certain things, like the definition of something so that you can write an example.

Instructor M also used group activities as a primary type of active learning, having tried different approaches in the past. Group projects and presentations are completed as a team, providing students with a variety of ways for them to develop their own ideas about the topic, sometimes presented as a proposal to the entire class.

> Instructor M Shared: The second option is a pedagogical route where there's just a design and then create certain parts of a lesson plan for high schoolers . . . and then the third one is a policy group where they have to do the research and then make a presentation to a state representative in [this state]. Imagining that they are giving advice about whether to mandate state funding . . . [for a controversial issue.] So, there's this typically immigrant community. Do research on this, and so on.

Other types of group activities attempt to relate the problem to the real world. Instructors stressed that the more the activities pertain to real life, the better. Instructor J uses artifacts such as real news items and issues that are affecting the world today, challenging

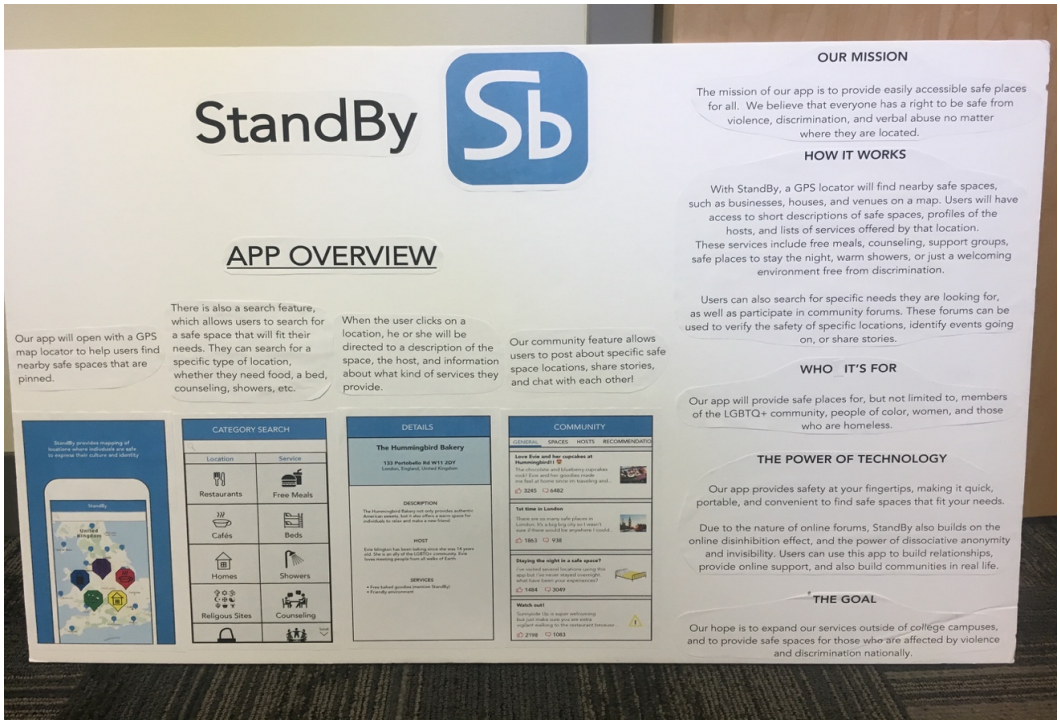
the students to find solutions. Instructors A, T, and M agree with this method, stressing that for students to be active, they need to be involved in real-world problems and issues. As Instructor K stated:

> Yes. I always try to relate it to the real world and make it active when they think about it. That example when . . . I said look to the financial section of the Wall Street Journal. You know you have the maturity and everything else. By talking about it in class they'll know what it means.

Some group projects used technology, as was evident from the interviews, classroom observations, and an examination of the artifacts. Instructor T adds new activities every semester, trying as much as possible to integrate technology into them. One example involved designing an app that helps the community; students worked in both groups and individually to put their ideas into a specific format. The poster below is a student project for Standby, an app that helps homeless people find local resources. The instructor stresses that students get involved in this kind of activity because they get a sense of what it feels like to be helping the community.

Figure 13

Poster of Mobile App Project



All the instructors agreed that the group tables help promote a variety of active learning activities, creating for students a sense of familiarity and comfort. The instructors feel that the closeness of the tables helps create a comfortable atmosphere for learning. They stressed, however, the need to be moving around during group activities to help students stay on task.

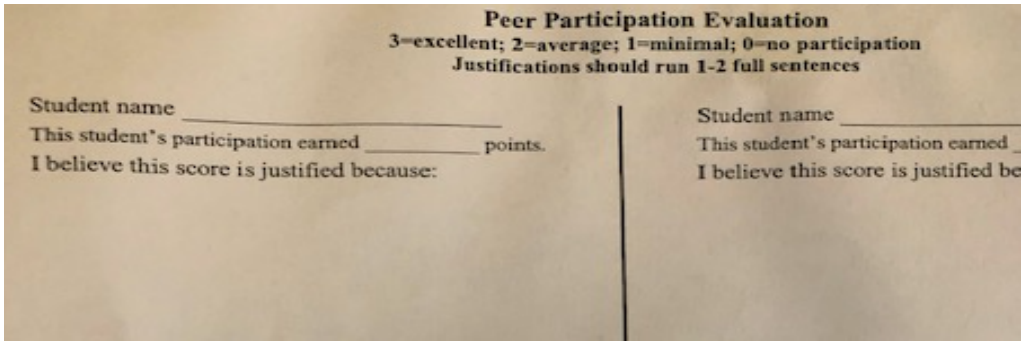
Assessment Activities

During the interviews, the instructors discussed assessment and how it plays a significant role in the ALC. Formative assessment techniques such as short quizzes, worksheets, and other assessment activities help monitor and measure student progress.

The instructors had some concerns that because of the physical layout of the classroom they needed to be sure that students understood the material and were paying attention. This was particularly an issue for those instructors who had large classes. To respond to these concerns, the instructors created several activities to ensure student understanding. Instructor A used a peer evaluation type of activity at the end of each active learning lecture to check understanding, which, because of the size of the class, were delegated to the STAs to administer. The peer review form, which the STAs tally, is shown below.

Figure 14

Peer Participation Evaluation



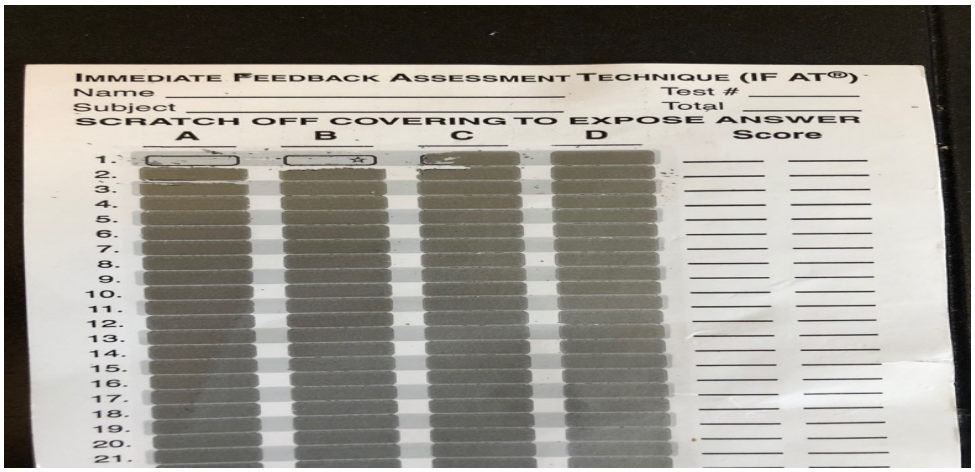
Instructor A provides students with a single question at the end of the class as a way for them to review the lecture, giving students about 10 minutes to write a short paragraph in response to the question.

> Yes, so at the end of each class, I'll put a question that asks them to demonstrate their understanding of the theory. It is kind of like a minute paper, but I give them up to 10 minutes to do it. And I say you know a well thought out paragraph or two

paragraphs that's all I'm looking for. It is graded in a different way. It is a pass no pass sort of thing. Five points.

Figure 15

IF-AT Assessment



Another example of an assessment activity is the "If-At Immediate Feedback Assessment" technique. Instructor T uses this self-scoring system, which provides students with immediate feedback about their answers and allows students to continue answering a question until they uncover the correct answer. The instructor says the students like this system because it is confidential and because they can see the answers on the big screen. The scratch-off technique seems to be an effective way to make sure students review key concepts (see figure16).

Figure 16

If-AT Scoring System

The amount of partial credit is up to you. Here are a couple of examples from http://www.if-at.com:

10 points – first choice 5 points – second try 2 points – third try 1 point – fourth try 0 points – fifth try	5 points – first choice 3 points – second try 2 points – third try 1 point – fourth try .5 point – fifth try

Some instructors, however, felt that group work has certain flaws. Instructor J worried that, because of the size of the class, all students were not staying on task. Instructor R also revealed that it is sometimes hard to manage the classroom dynamics:

> I float around obviously [but] when the instructor sits down, things get quiet. So, there's no way to share some of the more creative aspects or the more diverse concepts that are being discussed at the table level with the whole group. Especially when people are a little reluctant to express their views to the larger group because it seems safer at the table. People are afraid to express minority points of view if they feel they're in the minority which at the table level it's easier.

Findings Related to Question Three

This section details the main findings related to question three: "What are the instructors' perceptions of TEALC?" This section will review the perceptions of the instructors regarding TEALCs, what they see as barriers to teaching in this kind of classroom, and their recommendations for professional development support. Overall, the

instructors felt that TEALCs were beneficial to their teaching and to student learning. The overall consensus was that active learning provides students with a way to collaborate, interact, and learn. The physical features of the room facilitate the development of a comfortable environment and aid in group work. All the instructors agreed that the room's technology helped to an extent—when it worked properly. However, they mentioned some clear barriers and challenges that they faced in the ALC350. These barriers predominantly revolved around technology failure, time constraints, creating student-centered activities, and lack of training. Four instructors felt that instructional development training during their graduate years before becoming instructors would have been helpful and that online workshops and other training would be valuable to expose them to these new ways of teaching. The findings are addressed in detail below.

Overall Positive Perceptions of TEALCs

The instructors mentioned many perceived benefits of TEALCs, which can be described under three main categories:

Student-Centered Teaching

All the instructors agreed that technology enabled classrooms create a more student-centered environment than the traditional classroom without compromising course content and that the design of the classroom and the tables were beneficial for facilitating working in groups, collaboration among and between students, and active learning, increasing opportunities for student interactions as well as instructor-student interaction. The classroom dynamics are different from those in a traditional classroom and result in a more interactive teaching style. The role of the instructor changes

significantly from that of an expert disbursing information to that of a facilitator of student learning. Instructor J expressed this point clearly during the interviews:

> I think active learning is a concept in itself that has multiple dimensions. And there are different degrees of active learning. Now also remember active learning is a student-centered concept. So, you're like the facilitator, you're the trainer and you are kind of like an overseer of what they're trying to learn.

Nonetheless, all the instructors felt that lecturing was still an important part of teaching. All of them noted, however, that the time devoted to lecturing is significantly less in an AL space than in a traditional lecture hall. Their main feeling is that lecturing time can be reduced, that instructor-centered teaching should not take up all of the class time, and that interactive activities should be considered an important, but not primary, part of the class. Instructor A noted how one's lecturing might change over time, even though it always had elements of AL:

> I know that there are many other ways to teach but your experience and your teaching styles change and that's how students prefer to learn now by doing. I mean that's one of the things I've learned over the years too. The way I teach now is vastly different from twenty years ago. I do much less lecturing, which is nice. It is also so hard. It's hard right because you don't know what to expect when you change your teaching styles

The role of the instructor changes in a student-centered classroom, and lecturing time is generally reduced, and lectures tend to be at the beginning of the class or between activities. Instructor J's teaching style changed drastically from that used in a regular lecture hall:

> You lecture for 25 to 30 minutes and discuss it for 15 minutes. And most of the time it's like all going at the same time. So, it's not like you finished, and then you do the discussion. Like you do the lecture. It's both. So, for example, you know I was just finalizing my lecture for today. So, for example, today, I'm going to show them . . . [a video]. I give them time to watch the video and time to discuss.

Similarly, Instructor T tended to give shorter lectures with maybe a few slides before moving on to a video and then an activity. All participants agreed that, because of the physical characteristics of a TEALC, designing a student-centered class was quite different than designing a class for a traditional lecture hall.

TEALCs Helps Reach Learning Objectives

Another finding was that instructors felt that they needed to make sure that AL met their learning objectives. They felt that for AL to be successful, the activities needed to relate to the topic, the syllabus, and the learner outcomes. For example, Instructor A describes giving students the learning objectives for the day:

> I mean I have ideas about what I want to accomplish at the end of the class period. What I want students to know the learning objectives and that's what we do in that classroom. All right here are sort of learning objectives for the day that becomes sort of the check for the students as well as a guide for us as we're going through the day.

Instructor M agrees with this view and stresses that being active or not should be considered on a spectrum, pointing out that the nature of the activity depends on the learning objectives. Instructor R also explained that "coming up with ideas of how to use

the technology, that's not a problem either. The problem is to make sure that they're going to have a pedagogical outcome." All the instructors stressed that in order for the classroom to be a success, educational objectives, which were frequently mentioned in the interviews, must be met and were concerned about how to transmit information that was useful, engaging, and beneficial without compromising learning objectives.

Adoption Barriers

TEALCs are not, however, without disadvantages. Some instructors were from time to time discouraged by factors such as technology failure, time issues, classroom size, and the overall layout of the room. These were all noted throughout the study.

Technology Failure

All the instructors stated that using technology often comes with unplanned technical issues. They also believed that it is hard to maintain quality control of the class because they cannot predict when or what type of technical issue may arise. Therefore, all agreed that it was important for them to try out the technology to make sure it works before creating activities that revolve around it. Instructor R was concerned by saying, "my overall concern with it is just the lack of reliability because if I've designed a whole lesson around technology in a particular way and then it doesn't work, it's really deflating." Three Instructors felt that if they invest time in activities that are dependent on technology, they needed some kind of back-up method for delivering that content. He stressed that:

> One of the most disruptive things in a class setting is a technology failure. I know you don't know what the technology is going to freak out about until you push it. And so, I wouldn't want to invest too much in doing something in case there's a

> crash or something until once I felt comfortable that the technology. Once I know with the technology could do, I could integrate more and more stuff. I would add one thing at a time.

In addition, some instructors felt that they did not have adequate skills to resolve technical issues on the spot and continue with the class. They also had a concern that when technology does fail, it takes time to resolve the issue. Instructor M expressed this issue by stating:

> So, you can see around the inconsistency with the technology. So sometimes things just don't work like the screens will [not] come down or like you come in and can't log in to the computer. Last year there would times when like I can get the screens to work but I couldn't see it on my computer.

Time Management

Initially, the participants described a conflict between effective time management and the time required for AL. Instructors agreed that they needed more experience to understand how to teach actively but agreed that the lectures as planned allowed enough time for student-centered activities. The instructors felt that using technology generally can save class time, although sometimes that is not the case. Typically, instructors felt that time was a central concern when integrating technology and AL into their lessons. They stressed that they have organizational responsibilities and obligations other than teaching, which causes them to have less time than they might like to prepare for a more ALC. Although they all indicated a willingness to modify their teaching to accommodate the demands of the ALC, they often do not have the time to do so.

Instructor M mentioned that because the teachers have so much content to cover, sometimes only a few activities are possible, and that time and technology are closely linked:

> So, like that you know to use the screens you have to make sure that you have computers. And so, you know in a semester where you're doing a lot of other things sometimes there's no time.

Concerns with time also impacted the types of technology chosen, tending to gravitate to tools that save time and are effective, often choosing short videos to save time or allowing students to access information from their personal laptops. All instructors feel that PowerPoint presentations help with time management because they know that they covered important information before moving on to other activities.

Classroom Size as a Drawback

Some instructors felt that large classes were a drawback of successful AL, stressing that the smaller the class, the better AL outcomes. They think that large numbers defeat the purpose of AL because instructors cannot know who is working and who is not. As mentioned previously, some instructors found a solution to this problem by having TAs and STAs; one instructor who did not have that help commented that:

> I think it's harder with the big numbers. And not really enough time to cover everything. You know for [one of my classes] . . . they did write what 14 to 15 reaction papers they do one or two case studies and I grade them every week and put them up before they get on before the plot discussion starts and give them my comments. But for this class it was just because of the sheer size and the level of the class it becomes very complicated.

In addition to the high number of students in the classroom, instructors worry about not reaching all students. Instructor A stressed that because of the large numbers, knowing how much various students are retaining is a challenge and consequently needed to frequently check for understanding and to be sure all students were on task. Another instructor stated that:

> Active learning classrooms that are smaller they are the better in terms of teaching and the problems that they have with bigger lectures. They can't control like the group work, and you have TAs which you know it's a good thing to have right.

Clearly, all the instructors had reservations about the classroom size and about how much they can achieve during any given class session. Instructor J also made a fitting comment by adding, "Yes, I'm saying is that active learning is continuing. So, classroom sizes and other things change your active learning outcomes to a different level. You know so. So, a lot of factors affect the nature of active learning."

Classroom Layout Limitations

Although the majority agreed that the layout was beneficial for active learning, some instructors mentioned limitations of the layout. Generally, the instructors had an ambivalent relationship with the middle screens. One instructor said that, "even though I hated the middle screens at first, they grew on me." Another stated that:

> The first semester I absolutely loathed the middle screens, this is just horrible. When we do a whole class discussion it is a little awkward because I can't see unless I stand up and walk around. And some students can't hear each other because it's so big. So, I do a lot of repeating and paraphrasing. We do that as a whole group.

Another problem for some is that these middle screens cannot be moved. Although they can be moved up and down, they cannot be moved away from the middle of the room, and therefore one side of the class might be blocked by the screen from seeing the other side. As Instructor J said, "the monitors in the middle you know they kind of cut the class in two. They cannot be moved." Another limitation regarding the layout is that the triangle tables are very heavy and hard to move and would take too much time and effort to have them rearranged.

Despite the fact that the room has several screens and whiteboards, the whiteboards are hung so high that shorter students could only write on the bottom half of the boards. As Instructor A said:

> Exactly, it is still the same fairly fixed setup. I need more flexibility. They made an error when they saw it and then they have these white boards which I've never seen anything on the white board because they're too high.

Instructor T linked these two issues—unmovable tables and the high whiteboard—as follows:

> So, there's some stuff about like the physical layout . . . [that made it difficult to] get to the center of the tables to pick up their papers. I couldn't go between them because it's just not a big enough room to like to walk in between. Luckily my students are really really cool about it. . . . Another thing is we have whiteboards on the walls, which is like a great idea but in practice they are very high. So, they're not super useful [for shorter students and teachers] . . . .

In addition to this, an instructor explained that while pregnant, it was hard for her to maneuver between tables and that tables were so heavy they had a hard time moving

them and did not want to waste time moving tables. She explained that at six months pregnant, it was a challenge for her to teach and be mobile in the classroom.

Furthermore, instructors felt that they had issues when assessing students during class exams and quizzes because of the way the tables are set up and that exams were difficult to monitor because students sit so close to each other. To address this issue, instructors came up with different ways to avoid cheating. One instructor uses three versions of the same exam. Another instructor also used three different versions of a multiple-choice exam that is color-coded. Additionally, one instructor used a folder with the exam in it and the folder is placed in such a way that students sitting next to them cannot see each other's test paper. The last instructor used automated exams and made sure they had two different versions, which were given alternately between students.

Professional Development and Training

When it came to the questions regarding professional development and training, instructors had varied views. Some instructors attended an orientation workshop when the ALC350 first opened. They said it was mostly a marketing type of orientation, showcasing the features of the room and how they can be used for educational purposes. Others were "self-taught," stating that they had not received formal training but acquired skills through experience and on their own, in part by trial and error. Other instructors gained knowledge through personal research into the topic of active learning, modifying various activities to fit their curriculum, trying different activities, and changing things based on students' feedback. One instructor attended a workshop on active learning at a professional conference.

With regards to types of professional development, a few instructors felt that workshops and continuous professional development programs focusing on student-centered teaching is a must for all instructors, while others suggested providing professional development during graduate school and serving as a graduate teaching assistant would be better. In addition to this, some suggested short online workshops focused on active learning might help prepare faculty to teach in these spaces. It was clear that instructors wanted tangible, practical, and workable solutions for active learning and a resource to help them troubleshoot problems as they arise. Instructors proposed several ways to increase institution-wide awareness for TEALCs and related interactive teaching strategies. These included peer mentoring programs to share expertise and ideas. Instructor M mentioned the importance of gaining information from faculty who are enthusiastic about these activities, particularly early in one's teaching career, stating that:

> You developed your own teaching style or through specific mentors. So, I had mentors who gave me the opportunity to lecture and help me to practice.

Instructor M got little benefit from workshops on active learning, confirming the belief of some others that such training was just a waste of time.

Instructor K mirrored this dislike of formal workshops and felt that online professional development was better than face-to-face training and that active learning strategies should not be forced on instructors, believing that giving instructors the

> Tools to make them better . . . makes a lot of sense to me. But that person also may have an ego that's too big to say I'm not going to come and have somebody

> train me. But I can train myself in the privacy of my own house by watching a video. They can train on their own time.

Another instructor mentioned that it is best to have training after the first year of graduate school, where future instructors are still mainly learning. Instructor A, on the other hand, suggested a two-part orientation, preferably in one day, explaining that,

> Using the technology is not that challenging to learn. It's a little overwhelming at first that I'm familiar with it doesn't take that long to learn it. So maybe within the same session I think you need to integrate the active learning suggestions and components about how you make the technology use for pedagogical purposes.

Additionally, to the training, instructors proposed several suggestions for teaching in the TEALCs described below.

Starting with Small Activities

Instructors recommended that adapting their teaching for an active learning classroom should be taken in small steps and, as Instructor A suggests, begin with familiar activities that are easy to implement and will not overwhelm either the instructor or students. Instructor T suggests that beginning with a short video was a foolproof way to stimulate class discussions and enhance critical thinking skills. The idea of "starting slow" was seconded by all the participants, all of whom stressed the importance of giving students clear instructions for each activity to aid in delivering a smooth lesson.

Chunking the Class

Another suggestion that was made is to 'chunk' or divide the lesson up into sections. Much like Figure 1, sectioning class time into small segments was a clear strategy observed in the ALC350. Instructors shared their strategies for teaching using

'chunking' as a way to break up the class. Instructor J suggested that it is important to lecture for a relatively short time, stop to show a video, discuss information, and then move on to another topic. Instructor R agreed that breaking up classroom time is important because it created manageable pieces of information that are easily understood, arguing that students do better with shorter lectures than with longer ones. Instructor M agreed with this by stating that students lose attention quickly, so this is a way to keep their attention.

Immediate Feedback and Reinforcement

Instructors also felt that providing immediate feedback and reinforcement to students was imperative in terms of student learning and understanding. Instructor A demonstrated this point well during classroom observation by continually giving students feedback on their work, moving around the class and giving encouragement when needed and providing help to confused students. Instructor K felt that the only way to know if students are paying attention is to ask questions, wait for their answers, and then give them feedback if needed. Instructor M also stressed that making sure students understand information is a high priority, particularly when exposing students to new information. Instructor R stressed that no instructor can possibly know for sure all students “got it,” which makes giving as much feedback as possible during class so important.

Conclusion

This section pertained to the results composed from the data collected during this study. It identified participant demographics and attempted to answer the three main research questions of this research. RQ 1 discussed the utilization of the examined TEALC in terms of technology use, classroom teaching methods, teacher observations,

classroom design and teacher support. Q2 related to the main instructional strategies employed in a TEALC. RQ3 discussed instructors' perceptions of TEALCS in terms of barriers of adoption, factors of adoption, activities, and preferred professional development. Additionally, instructors identified recommendations for some barriers and well as how instructors can start teaching in these spaces. The subsequent chapter is dedicated to the interpretation of the findings, implications, recommendations for further research, and main conclusions

Chapter Five: Discussion and Conclusion

Discussion, Implications, and Recommendations

The purpose of this research was to understand and describe the perceptions of university instructors when teaching in technology enabled active learning classrooms (TEALCS) in higher education. Four undergraduate level instructors were observed and those four, along with two additional instructors, were interviewed regarding their perceptions of a technology enabled classroom, their instructional choices, and their teaching behaviors. This chapter presents a discussion of the main findings and implications of this study, its strengths and limitations, and directions for future research. The conclusions that were drawn from this research are intended to aid future instructors using these facilities and may provide guidelines for using TEALCs to enhance student-centered active learning approaches (AL) in higher education. Additionally, the findings of this research add to the existing literature on the topic by contributing to the knowledge base in the field of approaches to active learning. It will also help future researchers in the field of higher education effectively study different aspects and features of this type of classroom and provide guidelines for course design, professional development, and technology integration for those teaching in technology assisted classrooms. The research questions below to aim to fill the gaps in the literature on teaching in TEALCs.

RQ1: How do instructors utilize TEALCs?

RQ2: What strategies do instructors employ to facilitate interactive learning?

RQ3: What are the instructors' perceptions of TEALC?

Constructivist Theory and TEALC

The main findings of this study align with Dewey's (1938) theory of learning by doing. The results convey how instructors connect instructional methods to create active experiences that expand learner knowledge through the use of instructional technology tools and AL strategies. Constructivism argues that learning is an active process and that the use of technology integration delivers more excitement and engagement than is found in the traditional classroom (Bull, 2009). Constructivists focus on objectives such as higher-order thinking skills, critical thinking, and reasoning (Richardson, 2003; Yilmaz, 2008). These skills aid in providing an in-depth knowledge of the subject matter (Amineh & Asl, 2015; Richardson, 2003). The current study supports the belief that these goals may be met by providing technology assisted spaces designed to promote AL (Asamoah & Oheneba-Sakyi, 2017). For example, these innovative spaces are designed to facilitate constructivist methods of teaching such as collaborative, problem-based, and inquiry-based learning (Beichner, 2014, 2016; Blasco-Arcas et al., 2013; Florman et al., 2014; Prince, 2004; Van Horne et al., 2012). The findings of this study reinforce the position that AL requires meaningful, open-ended, challenging problems for the learner to solve. Although the literature on constructivism is vast (Ackermann, 2001; Amineh & Asl, 2015; Cobb, 1994; Phillips, 2000), the fundamental position of the theory is that the main challenge to learning is to involve learners as actively as possible in their own learning process.

Promoting Learner-Centeredness

One of the main takeaways of this research is that there is a shift in teaching direction and methods. The instructors in this study employed different instructional

technologies and utilized the TEALC space in different ways to involve their students in several collaborative and engaging activities. The pedagogical reasoning behind these choices was primarily based on the belief that student-centered activities would result in better, more significant learning. The data showed that instructors utilized TEALCs in ways that promoted student-centered learning by encouraging collaboration, group work, and minimizing lecturing time. The main group work activities observed in this study were case studies, problem solving activities, student projects, and full class debates and discussions.

Although several strategies are available to help promote AL (Wolff et al., 2015), the choice of which activities to employ depends on several factors such as course content, learning objectives, experience, and learner-engagement. The result of the current study indicates a consensus among the instructors that this type of space had improved the efficiency of group activities. The configuration and design of the ALC may have helped, and even motivated, instructors to teach in a more learner-centered manner. The way the tables were set up may have also helped students become more involved and collaborative with their peers. These results are similar to other studies in the field (e.g., Beichner, 2016; Soneral & Wyse, 2017).

The group activities used by the instructors in this study have long been documented as an effective method to promote problem solving, decision-making, and time management skills (Bonwell & Eison, 1991; Long et al., 2016). Several studies have investigated the positive effects of group activities (Chiu & Cheng, 2017; Kinoshita et al., 2016, 2017; Park & Choi, 2014). Cherney (2008) reported that AL group work assisted in greater knowledge retention and student engagement. Another study conducted by Gordy

et al. (2018) revealed that technology-assisted learning spaces enhanced the efficiency of group work, which is also consistent with other studies (Park & Choi, 2014).

Another important finding of this study is that the use of these spaces by the instructors reflects a desire to promote learner-centered pedagogy. This aligns with other studies that have shown that, when used correctly, TEALCs increase learning achievement while creating an enjoyable environment for both students and instructors (Abdullah et al., 2018; Beichner, 2016; Chan et al., 2016; Chi et al., 2014; Daniel & Tivener, 2016; Freeman et al., 2014). In these environments, learners take more responsibility for the learning process and their learning goals (Baepler et al., 2014, 2016; Dori & Belcher, 2005; Dori et al., 2007). Thus, the results of this study show in particular that the result of teaching in a TEALC suggest a gradual shift from teacher-centered instruction to student-centered learning. The results also support previous research that shows that teaching in these classrooms shifts the role of the instructor from a dispenser of information to that of a facilitator or guide in the learning process (Baepler et al., 2016; Bull, 2009). This reinforces the findings of Phillipson et al. (2018) that teaching in these AL spaces encouraged "transformative learning," since instructors in the study clearly shifted their perceptions regarding their roles in the classroom in a similar manner.

The Role of Technology in Active Learning Spaces

This study investigated the way the instructors in this study used the technology in the TEALC and their reasons for doing so, other than simply its availability. The study revealed that the majority of instructors used primarily those technology tools they were familiar with and comfortable using. TEALCs are configured with the latest technologies, hardware, and a unique configuration of tables. Although these technologies enhanced

spaces have clear benefits and contribute to learner success (Baepler et al., 2016), they also present a challenge for instructors that might not have the proficiency in technology integration or training in active learning methodologies.

Instructors in this study used technology primarily to deliver content, such as the LCD TVs, the projectors, videos, and the central podium. PowerPoint was mainly used for providing content and, at times, to aid in completing student activities. Instructors in this study appeared generally motivated to use multimedia and instructional technology tools to help deliver content. These findings agree with similar finding in several published works (Beichner, 2016; Siegel & Claydon, 2016). However, the researcher found that this type of technology-rich environment did not cause instructors to entirely abandon lecturing; instead, the space encouraged them to reduce the amount of lecture time and shift to a more constructivist approach for at least part of the class. It is almost as if the mere setup of the room forced them to limit their lecturing to favor more collaborative activities.

The Role of Lecturing in Active Learning Spaces

The results of this study provide valuable insights into the role of lecturing in higher education. As Harrington and Zakrajsek (2017) point out, lecturing has been the major way of teaching in higher education for nearly a millennium but that in recent decades the method has come under considerable criticism from those promoting more active, student-centered learning. Harrington and Zakrajsek argument, however, is that lecturing is still a viable and effective method of teaching, especially for undergraduate courses, if done well. They believe one way of improving lectures is by making them shorter, more to the point, and, if possible, combined with more AL strategies. Breaking

up lectures into small manageable chunks creates a different and more engaging classroom dynamic. In this study, it is evident that all the instructors felt that lecturing was still an important part of education but that, at least in ALCs, lectures should be shorter to provide time for more active, student-centered activities. This confirms research that has shown that lectures are not entirely eliminated in ALCs but that they tend to be delivered in shorter chunks (Baepler et al., 2016; Revell & Wainwright, 2009). All the instructors nevertheless still considered lecturing time important and even stressed that this is the time that they can deliver relevant content before moving on to activities hopefully related to the content of the lecture. Revell and Wainwright (2009) conducted a study on ten geography lecturers and 24 undergraduate students at Brunel University to investigate what makes a lecture "un-missable." The results showed that students were more likely not to miss class if the lecture had three factors: (1) "a high degree of student participation and interaction"; (2) "a clear structure which enabled students to identify key points and make integrative links with other areas of the course"; and (3) "the passion and enthusiasm of the lecturer, and the degree to which she/he can bring a subject to life" (p. 214). Clearly, the more actively involving a lecture is, the more students wanted to come to class.

The findings of the current research also support Revell and Wainwright's (2009) position that a good lecture should "include regular breaks for discussion and group activities, such as buzz groups, brainstorming, debates, role-playing, plenary sessions, problem-solving, presentation work—anything that got students involved and thinking for themselves." (p. 214) These findings are similar to other studies that investigated ALCs (Bean, 2011; Fosmire & Macklin, 2002; Karamustafaoglu, 2009). Schmidt et al.

(2015) agree with Harrington and Zakrajsek (2017) that lecturing is "the most used didactic instrument in teaching students in higher education" (p. 17) but suggest that lectures are only partially effective because of limited participation and, in general, tend not to promote critical thinking. Therefore, adding active, student-centered activities to lectures to create a more interactive classroom is essential for learning. During classroom observation, lectures were still clearly used but had been modified in several ways to promote more AL as follows:

1. The lectures were relatively short compared to the total class time available and ranged from 12-25 minutes.
2. The lectures incorporated several pauses to check for student understanding.
3. The relatively short lectures were followed by longer activities that involved students in discussions, interacting with each other and the instructor.
4. The instructor provided feedback after each activity.
5. In those classes that used more than one activity in a single classroom, this cycle was repeated.

Perceptions of a TEALC: Benefits and Challenges

The findings related to instructors' perceptions indicated that the instructors in the study favored AL, had positive perceptions regarding active learning strategies and agreed that these spaces had a likely positive impact on student performance and learning. All the instructors perceived the use of technology as helpful in providing activities that involved students and created an engaging learning environment. They recognized that AL promotes critical thinking and creates strong group dynamics between students. This finding is similar to other studies in the field (e.g., Bean, 2011;

Florman, 2014). Several challenges involving AL and the classroom were mentioned, including technology failure, classroom layout, class size, assessment, and time. In facing these obstacles, all instructors suggested providing training and other resources to help with problems, in addition to wanting help with issues such as classroom management and assessment strategies.

The current study investigated the perceptions and attitudes of six instructors toward the positive and negative factors involved in teaching in a technology assisted classroom and the way those factors influenced their choice of teaching strategies. It was clear that these choices were made based on a mixture of personal preference, teaching experience, perceived challenges, and individual teaching styles. The positive and negative issues involving AL have been examined in previous research (e.g. Aksit et al., 2016; Kopcha, 2012; Eickholt, 2018; Khan & Pardo, 2016; Miller & Metz, 2014; Park & Choi, 2014; Wolff et al., 2015) and have found that the main challenges faced by instructors in these classrooms are related to such factors as lack of time, the need for instructional support, classroom layout, class size, training, and the need for technical support.

Throughout the interviews and observations, it was evident that instructors saw many positive adoption factors to teaching in these classrooms as well as several barriers as identified in previous research. The current study, however, showed how barriers, when properly addressed, became adoption factors. For example, technology failure and the lack of troubleshooting support were considered as barriers to adoption, but when the technology functioned properly and when instructors received the right support, the adoption of technology was not a problem. This study showed how crucial it is that

instructors comprehend how to properly integrate content with the proper technology and that instructors believed that this technology integration was beneficial when it was reliable and relevant to the activity, which is consistent with the constructivist theory of AL (Park & Choi, 2014; Wolff et al., 2015).

Lack of Time

Lack of time is commonly cited as a barrier to adopting technology in these classrooms (Eickholt, 2018). More specifically, the current study found that instructors did not have the amount of time they would have liked to spend before class to create AL activities. Miller and Metz (2014) reported in a comparable study that 89% of participants expressed their concerns about time when creating and executing AL. Similarly, the instructors in the current study showed that preparing AL activities took a considerable amount of time and that it took teaching several courses in an ALC before feeling comfortable with student-centered activities. Instructors mentioned frequently changing the design of individual classes, trying out various activities, and creating new ones based on trial and error; once having identified successful and reliable activities, they had more time to invest in continuing to make their teaching more active. This finding is similar to a study by Van Horne et al. (2014), which showed that instructors reported substantial time was needed to create and convert conventional lectures into the new AL environments. And because the instructors had other duties, including research and various university-wide responsibilities, more time was needed to become proficient in teaching in these environments.

With experience and when used correctly, the instructors felt that technology did save them time; for example, using the screens to show students' work and give

immediate feedback was seen as a way to save time for one-on-one instruction. Less time needed to be spent on lectures because the group work helped answer typical questions and allowed formative feedback. Other instructors felt that time spent on discussions provided more profound insights for the students and that time, therefore, had both positive and negative aspects. This finding is significant for instructional technologists, course developers, and instructors because it can help them when it comes to professional development and support. For instance, if instructors reported lack of time as a barrier, they could be assured that the investment of time over a few semesters to modify class content to meet the needs of an ALC and to create successful student-centered activities would save time in the long run, thus becoming a factor for adoption.

Need for Support

Another factor that was observed in this study as a positive factor leading to the adoption of AL strategies is the availability of support. The instructors that did not have support in terms of graduate or undergraduate student teaching assistants felt that is was hard to keep students on task, whereas instructors that had such support found classroom management much easier. Therefore, when support is present and effective, it will help achieve the goals of AL, especially for classes with a large number of students. This supports the research regarding AL classes, particularly those with large numbers, which shows that it is essential to have that extra help (Allen & Tanner, 2005; Ruder & Stanford, 2018).

Besides the support provided by teaching assistants, having technical support is another critical factor in the successful adoption of ALCs. Instructors need to have immediate on-site support to troubleshoot problems as they arise. Although lack of

support was not seen as a specific barrier, instructors did have concerns about technology that needed to be fixed on the spot. Many were reluctant to use certain technologies unless they had time not only to try them out before class but also time to invest in the effort to design lessons that used them. Support should be offered at all times, both when instructors are teaching and when they are planning their classes. This can help minimize time issues and technology failure as problems arise (Darling-Hammond & Gardner, 2017; Eickholt, 2018).

Classroom Layout and Size

Classroom layout was considered a valuable asset that provided a collaborative, informal space. The findings indicate that the room is properly set up for maximum group work dynamics. All the screens on the walls of the room promoted collaboration and teamwork. However, the findings indicate that the permanent middle screens are not practical and are seen as a challenge and a hindrance. The instructors all noted that the screens are not movable and that they block sightlines. Instructor A also felt that the middle screens tended to "cut the room in half," in a sense almost creating two classrooms rather than one room. The findings also indicated that instructors disliked larger classes, which, because of the high numbers, were harder to manage. Previous research, however, suggests that AL can work successfully in both small and large classes, given the appropriate instructional techniques (Adrian, 2010; Diesel et al., 2006; Smith & Cardaciotto, 2011). Nonetheless, smaller classes do present fewer challenges (Frederick, 1987). The findings also showed that instructors that had the help of TAs or STAs held far fewer negative opinions regarding large classes, stating that even those classes were relatively easy to manage and that the students in those classes were

productive. Finally, the high whiteboards were considered problematic, especially for shorter instructors and students.

Assessment Challenges

Academic assessment may be either formative or summative, and both types were observed during classroom observations. Many of the student-centered learning activities served as a kind of formative assessment and many instructors used spot quizzes, but summative assessment was nevertheless an important part of the curriculum. However, the instructors felt that administering exams and quizzes in this type of layout was problematic because the triangular tables each seating nine students increased the possibility of cheating, and different instructors used different strategies to address this problem. These strategies including asking students to stand up a folder on edge to shield exam papers from the eyes of other students at the table and using two or three different versions of an exam, sometimes printed on different colored paper to emphasize the fact that different students were taking a different version of the exam even at the same table.

These strategies may help provide direction for future professional development activities to specifically address the challenge of formative and summative assessment in TEALCS, a professional development practice that has been well documented in the literature (Baepler et al., 2016; Darling-Hammond & Gardner, 2017; Florman, 2014; Pelletreau et al., 2018). Implications for this finding include developing specific workshops for different formative and summative assessment depending on the needs of the instructors. This kind of professional development would be particularly important for instructors new to active learning classrooms.

To address these and other challenges of teaching in a TEALC, Peterson and Gorman (2014) offer the following recommendations:

1. Before class:
    - Design activities that meet your learning outcomes and take advantage of the space.
    - Decide what technology you will and will not use.
    - Take an incremental approach to changes in teaching.
2. First Day of Class
    - Communicate your philosophy about teacher and student roles.
    - Articulate expectations for student-instructor and student-student interaction.
    - Inform students that you will solicit their feedback.
3. During Class Sessions
    - Direct student attention during class.
    - Set aside time for large group interaction.
    - Ask for student feedback early in the semester. (p. 70)

Professional Development and Training

The results of this study support the previous finding that the most effective type of professional development is centered on the practical needs of the instructors (Darling-Hammond & Gardner, 2017; Florman, 2014; Pelletreau et al., 2018). The instructors expressed their thoughts regarding professional development and training preferences for instructional technology and teaching in a TEALC. The findings showed their comfort

levels varied when it came to what type of training is required. Although most of the instructors felt comfortable with technology integration, two instructors had some reservations about some of the technology and how much technology should be used. Other instructors felt that it would be beneficial for them to get ideas on different AL activities. In addition, findings from this study suggest that professional development very much depends on individual preference. Some instructors prefer online training, whereas other instructors prefer live training. Instructors also elected to meet with other instructors for individualized instruction rather than attending an official professional development workshop, which should be seen as a possible alternative to formal training. These findings support previous research on faculty development that specifies that instructors prefer having the chance to share ideas with their peers (Tyrell, 2015).

These findings are particularly crucial for faculty developers and scholars to address in designing courses, providing support, and creating ongoing programs. Another finding from this study shows that instructors prefer training during graduate school. This aligns with a study by Patrick and Wischusen (2019) that shows the benefits of training graduate assistants before graduation to give them tools and strategies for AL. Other current scholars have reported that adequate and consistent professional development and training can help several instructors overcome some of the barriers discussed above (Eickholt, 2018). Darling-Hammond and Gardner (2017) propose that effective professional development should be content-focused and presented in the context of specific disciplines. They also support the idea that such professional development should include strategies for AL and collaboration, which help instructors understand the design and purpose of different activities and experience first-hand the outcomes of these

activities and how they impact their students. Florman (2014) describes the professional development provided at the University of Iowa and explained that the workshops had a focus on such hands-on activities as inquiry-based learning, team-based learning, and peer instruction, as well as providing insights for instructors on how to create their own student-centered learning activities. The instructors in the current study agreed that providing short, just-in-time support is best for AL. During the interviews, the researcher found that instructors informally shared ideas, solved problems, and provided support for each other, even creating informal networks within their disciplines to share information and successful AL strategies.

Implications for Practice and Policy

The current study provides evidence for instructors, policymakers, instructional designers, administrators, and researchers in developing recommendations to resolve challenges associated with TEALCs. In addition to this, this study reinforces the implications of previous studies to promote AL and active learning spaces in higher education. Although the results of this study show that the informal types of professional development seem to be the most effective and most preferred by instructors, institutions of higher education need to provide instructors teaching in technology enhanced classrooms consistent administrative support (Miller & Metz, 2014; Tharayil et al., 2018) that can be provided online, thus avoiding the scheduling and attendance problems of live professional development workshops, although such workshops are generally considered a more cost-effective way to use technology and to train faculty (Eickholt, 2018).

Another way to help instructors' transition from traditional lectures to teaching in a TEALC is to provide in-service training as well as workshops consistently throughout

the academic year, despite the logistical problems associated with such training (Cotner et al., 2013). This training may be on a departmental level or a faculty level. Assessing the training needs of instructors is a vital part of creating technological literacy, teaching method advancements, and pedagogical knowledge (Felder & Brent, 2004). Another implication of this study is that instructors should be encouraged to work individually to restructure existing courses and revise content to be more active (De Novais et al., 2017).

To add to this, the current research highlighted the lack of training provided at an institutional level. This may be seen as a problematic issue because there is a disconnect between the high investments to create these spaces and the lack of instructor training. It is important for policy makers to put value on the training aspect of active learning before putting the investments into the spaces. Therefore, the focus should be preparing future faculty to use these teaching methods in conjunction with ongoing evaluations. It is also imperative that instructors have a community, where that can become involved in the ever-changing teaching methods, which include new concepts such as AL. This will help prepare efficient educators that can use these spaces to their full capacity and have a support system.

A summary of the main concepts highlighted in this research is as follows:

1. Institutions and universities must implement consistent and readily available professional development programs and workshops that:
    - Promote strategies that help learner-centered pedagogy.
    - Design activities and strategies for small and large group dynamics.
    - Provide training regarding instructional technology available in these spaces.

- Provide resources that are easily accessible to instructors.
- Develop ways to use formative assessment strategies.
- Explore solutions for exams and summative assessments.

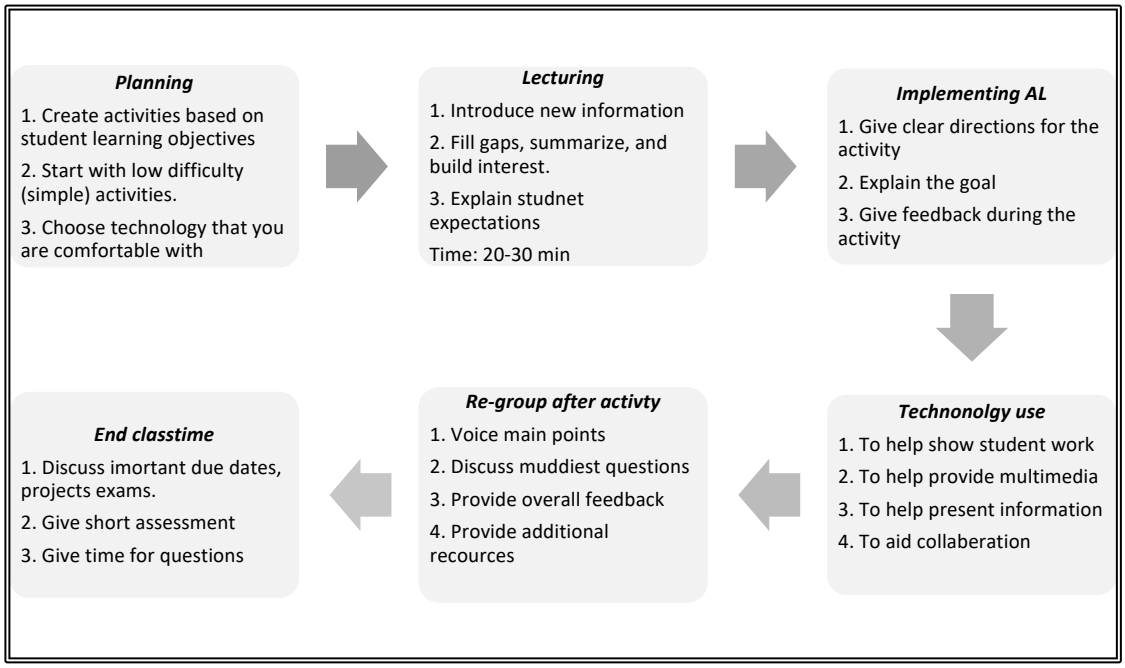
2. Establish incentives for instructors in all disciplines to encourage them to participate in professional development programs and national conferences that focus predominantly on active teaching strategies and the utilization of TEALCs.
3. Start a mentoring program that helps instructors new to technology assisted classrooms and provide support from instructors experienced in active learning.
4. Have onsite troubleshooting support in place during teaching hours to address instructor concerns and provide onsite assistance for technology problems.

Proposed TEALC Teaching Blueprint

One of the main concepts that emerged from this study is a suggested blueprint for future instructors. This blueprint can be modified and altered to suit individual needs. The previous literature, combined with the data collected in this study, has made it clear that AL takes time to learn how to facilitate, requires small steps to implement, particularly in the beginning, and is ongoing, often based on trial and error, modifications, and consistent technology. Figure 17 offers a suggested blueprint to establish and manage an ALC.

Figure 17

TEALC Teaching Blueprint



Strengths and Limitations of the Current Study

The current research used qualitative methods to gain a deep understanding of the way a selected group of six instructors teaches in a technology-enabled classroom. Several data sources were used, including interviews, observations, and teaching artifacts, which resulted in a rich investigation of how instructors are using ALC. The findings of the study regarding the key factors of adoption, technology use, activities, and teaching strategies, are potentially synergistically interrelated and provide significant implications for future educational reform and curriculum redesign and offer a guide for professional development. Since the six participants varied in experience and academic backgrounds, the results of this research are relatively comprehensive and more generalizable than a

study of less diverse instructors. The trustworthiness of the study was enhanced by the use of a previously designed and validated observation tool, the active learning classroom observation tool (Birdwell et al., 2016).

No study, however, is without limitations. The first limitation is that this study was conducted in a single public university, which may limit its applicability to other technology enabled active learning contexts. In addition, data were collected only over a single semester, and the study of more classes over several semesters in an even wider range of disciplines than those represented in the current study might yield different results. In addition to this, the group has specific criteria for being in the study; therefore, in order to replicate the study, the same criteria need to be met. In addition, the study only focuses on one group with one specific classroom setting and at one university and no other universities, which may have different features or different insights. The TEALC may also have different specifications, technologies and layout, which may affect the results of the study.

Additionally, this study did not interview or focus on students, and therefore the perceptions and attitudes of students regarding AL might vary considerably from the perceptions and attitudes of their instructors. Another limitation is that this study did not investigate student perceptions of these spaces and how the different teaching methods made a difference in their learning.

Directions for Future Research

This study was conducted as a qualitative study that included six undergraduate instructors currently teaching in a higher education undergraduate setting, with data collection conducted only over a single semester. Thus, there is a chance to expand this

research in several different directions. First, conducting a longitudinal study may be beneficial in tracing the movement, if any, of instructors toward a more comprehensive understanding of their role and instructional choices in TEALCs. Second, the teaching of one or more instructors could be observed before and after involvement in a professional development program to document changes, if any, as a result of such training. Third, the results of the differences, if any, between one-on-one instructional development versus a workshop approach to professional development could be studied. Fourth, researchers could study the results of instructional development training conducted during graduate school regarding teaching in a technology-assisted classroom, on technology integration, and on active learning teaching strategies. This could be followed by studying the effects, if any, of such training on these students after graduation as they begin their teaching careers. Additionally, it may be beneficial to explore spaces that are upgraded from the traditional type of classroom to see how the change to these spaces impacted instructors teaching practices. The results of such a study might shed light on the value, if any, of professional training for graduate students. To add to this, researching accessibility in this type of space may be beneficial as this topic entails several aspects such as hearing, sight, movement and special needs in terms of technical issues, space design, and function.

As was pointed out above, one of the limitations of the current study was its focus primarily on instructors; a wide range of research possibilities would open up on the perceptions and attitudes of the students in ALCs and, in particular, the correspondence, if any, between those perceptions and attitudes of their instructors. Finally, faculty development programs might create one or more research-based online professional development courses focusing on AL strategies and then examine the extent to which

those courses resulted in changes, if any, in the teaching of those involved in those courses. All of these research directions could lead to further valuable knowledge on best practices and how instructors can benefit from future professional development efforts.

Final Thoughts and Conclusions

This research helped shed light on how instructors use technologies and interactive learning strategies in a technology-assisted classroom and provided insights into the pedagogical reasoning of the participants, the benefits they saw in teaching in such settings, and the barriers they experienced in using these spaces. The primary results of this study are:

a) This study of TEALCs may help improve learning experiences by encouraging the use of AL strategies, by examining the usefulness of the technology generally found in these spaces, by exploring the consequences of a classroom that is less structured and perhaps more informal than the traditional lecture hall, and by promoting the value of collaboration and peer interaction.
b) TEALCs may be part of a larger shift in higher education from traditional teaching styles to a more student-centered instructional practice.
c) Instructors perceive AL spaces as more beneficial than the layout of the traditional lecture hall.
d) Instructional development should provide individualized approaches to training instructors in higher education.

The educational reform of instructional practices in higher education may need to start with the individual instructor. For AL to be promoted more broadly and for TEALCs to be utilized more effectively, instructors need to be comfortable with technology use,

interactive teaching strategies, and informal learning spaces. The current research adds to the body of literature that aids instructors, practitioners, and university administrators in designing programs and environments that successfully promote and implement AL. A good start for any instructor wishing to move toward AL is to initially adopt low-risk strategies and activities and to use technology that is easy to operate before moving more heavily into AL. Faculty developers and policymakers can help direct and support members to slowly change their instructional styles by promoting workshops, providing onsite help, and offering one-to-one training. More importantly, these findings help inform those stakeholders in the educational system that can influence reform in higher education. It is crucial to understand that to effectively implement AL in higher education, a clear, comprehensive picture of how teaching and learning might be transformed is essential. As McLaughlin and Metz (2016) maintain, a shared vision is critical to the success and longevity of any curriculum reform movement.

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Appendix A

Pre-Observation Checklist for Active Learning Spaces Observation

1. What would you like me to focus on as I observe your course?
2. What is your learning objective for the class I am about to observe?
3. How have you designed your class session to achieve this goal?
4. How are you planning on using the affordances of the room to support your goals? To support active learning. To support collaborative learning.
5. Is there anything else you would like me to consider as I observe this class?

When possible, at each stage of the observation, provide a diagram or blueprint to act as a point of reference for discussion about activities and interactions. A diagram or blueprint can be a particularly useful point of reference in spaces with configurable furniture.

Appendix B

Chronological Note-Taking Instrument

Use this form for note-taking during the observation.

Under the "Time" category, note the time and duration of activities and the various interactions that took place during the observation. Under the "Description" category, note what happened during the class, offering merely descriptions of events observed. Under the "Comments" category, note thoughts, possible suggestions, or reactions to what you are observing. After the observation, use the information and ideas gathered and organized in the form to inform your responses to the ALCOT.

Time	Description	Comments

Active Learning Observation Tool

Instructor:	**Department:**
Course:	**Section:**
Course Enrollment:	**Classroom:**
Observation Date:	

Use the following criteria that apply to guide your classroom observation descriptions, comments, and suggestions:

1. **Instructor use of the Active Learning Classroom to support active learning:**
    a) In what ways did the instructor engage students in active learning during this class?
    b) How did the instructor use instructional technologies in the room (i.e., media, tables, huddle boards) to engage students in in-class activities and instruction?
2. **Collaborative Learning in the Active Learning Classroom:**
    a) How did the instructor engage students in collaborative learning?
    b) How did the instructor provide directions for collaborative activities?
    c) How did the instructor ensure that <u>all</u> students participated in collaborative activities?

3. **Formative Assessment in an Active Learning Classroom:**

    a) What artifact(s) of learning did the instructor ask students to produce during (or prior) to class?

    b) How and with whom did students share their artifacts?

    c) How did the instructor provide feedback to students during learning activities or assessments?

    d) How did the instructor facilitate peer feedback during learning activities or assessments?

Classroom Management in the Active Learning Classroom

a) How did the instructor indicate where students needed to focus for various methods of instruction?

b) How did the instructor use the classroom space while engaging the entire class in a presentation or a learning activity? Did they walk around? Could students see, hear, or find the instructor?

c) How did the instructor make transitions between different instructional events (e.g., move from lecture to group activity)?

5. **General Observations:**

    a) What instructional choices worked exceptionally well?

b) What instructional choices do you think could be improved and how would you improve them?

Appendix C

Semi-Structured Interview Questions Protocol

TEALCS study

Demographic

1. How many years of teaching do you have?
2. How many years of teaching in ALC or a TEALCs have you had? two years
3. What got you interested in TEALCs?
4. What's your area of study?

Questions regarding the training and room

1. How familiar are you with active learning?
2. Did you receive training? If so, how was it?
3. What changes did you make when using the TEALC?
4. Did you take a long time to adapt to the new room setting and environment?

Questions on teaching methods

1. What active learning strategies do you utilize in the active learning classroom?
2. How do you prepare for the activity? instructions? materials? Participation online.
3. What is your favorite collaborating teaching method/ activity? and why?
4. What do you do in your class that is considered active?
5. What made you choose this type of active learning classroom? Why?
6. What are some of the difficulties that you experience while using active learning strategies?

7. What are some of the difficulties that you experience while teaching in the room?

Technology Use

1. Tell me about some specific examples of what technologies you have used in the past that help creates a more active learning classroom.
2. What technology do you use in the classroom?
3. Do students use the technology provided to them in the TEALCS?
4. What is some technology related activities that you employ in your class?

General questions

1. Do you feel that this teaching method and the layout of the room help create collaboration and active learning or hinder it? Why?
2. What are the things you love about teaching in this class? why?
3. What are the difficulties of using this room? why?
4. How can universities better prepare faculty to use these technologies? And active learning environments?
5. Would you teach in this room again? Why? why not?
6. What advice do you have for future instructors and faculty for using this room and this teaching approach?

Appendix D

E-mail Document for recruiting participants

I hope this email finds you well. My name is Nadeyah Alreiahi and I am a PhD student in the Instructional Technology program, at Ohio university. This email is to formally invite you to participate in my dissertation research study. The aim of this study is to examine university professor's perceptions of effective teaching when using Technology Enabled Active Learning Classrooms (TEALC) in Higher Education specifically in teaching the undergraduate level in all disciplines. The study will explore the pedagogical rationale behind your decisions when choosing technologies and how they fit into an active learning space. It will help understand what techniques are used and why. In addition, the results of this study may help fill the gaps in the present literature and better inform faculty professional development programs in these areas. It will help ensure faculty sound guidelines for employing this type of teaching to help create a more learner-centered approach to education.

Each participant will take part in one (30-45 minute) interview and one classroom observation in the Active Learning Classroom Schoonover 450. Participation in this study is voluntary and you may withdraw at any time. The data will be protected and stored in a password protected device.

Your participation is important to me and will make a valuable contribution to the existing body of research in the field of active learning in higher education. Please feel free to contact me at any time.

Thank you in advance

Nadeyah Alreiahi

IRB number: 19-X-14

Email:

Cell:

[date:01/29/2019]

Appendix E

Ohio University Adult Consent Form Without Signature

Title of Research: **The Observed Use of Technology Enabled Active Learning Classrooms and Interactive Learning Strategies in Higher Education: A Case Study**

Researchers: Nadeyah J. Alreiahi

IRB number:19-X-14

You are being asked by an Ohio University researcher to participate in research. For you to be able to decide whether you want to participate in this project, you should understand what the project is about, as well as the possible risks and benefits in order to make an informed decision. This process is known as informed consent. This form describes the purpose, procedures, possible benefits, and risks of the research project. It also explains how your personal information/biospecimens will be used and protected. Once you have read this form and your questions about the study are answered, you will be asked to participate in this study. You should receive a copy of this document to take with you.

Summary of Study

The purpose of this study is to examine university professor's perceptions of effective teaching when using Technology Enabled Active Learning Classrooms (TEALC) in Higher Education specifically in teaching the undergraduate level in all disciplines. The study will explore the pedagogical rationale behind your decisions when choosing technologies and how they fit into an active learning space. It will help understand what techniques are used and why.

In addition, the results of this study may help fill the gaps in the present literature and better inform faculty professional development programs in these areas. It will help ensure faculty sound guidelines for employing this type of teaching to help create a more learner-centered approach to education.

Explanation of Study

It you agree to participate in this study, one of your lectures will be observed by the above researcher. In addition, one 30-45-minute interview will be done after the classroom observation.

Additionally, the researcher might ask you to collect some classroom artifacts such as lessons plans. You should not participate in this study if you do not want to be observed or interviewed.

Risks and Discomforts

No risks or discomforts are anticipated.

Benefits

This study is important because it will add knowledge regarding best practices for teaching in higher education. Particularly with regard to using active learning classrooms in a university setting. Individually, you may benefit as professors and active instructors in the field. The study may provide insights into your own teaching.

Confidentiality and Records

Your study information will be kept confidential as all the participants will have aliases.

Compensation

As compensation for your time, coffee and cupcakes will be provided.

Future Use Statement

Identifiers might be removed from data/samples collected, and after such removal, the data/samples may be used for future research studies or distributed to another investigator for future research studies without additional informed consent from you or your legally authorized representative.

By agreeing to participate in this study, you are agreeing that:

- you have read this consent form (or it has been read to you) and have been given the opportunity to ask questions and have them answered;
- you have been informed of potential risks and they have been explained to your satisfaction;
- you understand Ohio University has no funds set aside for any injuries you might receive as a result of participating in this study;
- you are 18 years of age or older;
- your participation in this research is completely voluntary;
- you may leave the study at any time; if you decide to stop participating in the study, there will be no penalty to you, and you will not lose any benefits to which you are otherwise entitled.

Appendix F

TEALCS Nodes- Code book

Name	Files	References
Adoption Barriers	11	38
Classroom layout disadvantages	14	46
Classroom size disadvantage	6	16
Exams	5	12
Technology failure	7	9
Time	5	20
AL Activities	13	62
Discussion	9	33
formative assessment	6	14
Feedback	6	12
Group work	12	33
Professional Development	5	19
Prior training	3	7
TEALC factors of adoptions	1	1
Advantages	4	5

Name	Files	References
quotes about AL	4	6
Table layout	6	12
Teaching Assistants	7	10
Teaching style	10	46
Active learning perspectives	5	8
Advice	4	9
Curriculum	4	8
Experience	6	19
Learning objectives	5	8
Lecturing	8	25
Student perpetration	7	9
Technology use	17	74

Appendix G

IRB Approval

Project Number	19-X-14
Project Status	APPROVED
Committee:	Social/Behavioral IRB
Compliance Contact:	Rebecca Cale (cale@ohio.edu)
Primary Investigator:	Nadeyah J M A J Alreiahi
Project Title:	The Observed Use of Technology Enabled Active Learning Classrooms and Interactive Learning Strategies in Higher Education: A Case Study
Level of Review:	EXPEDITED

The Social/Behavioral IRB reviewed and approved by expedited review the above referenced research. The Board was able to provide expedited approval under 45 CFR 46.110(b)(1) because the research meets the applicability criteria and one or more categories of research eligible for expedited review, as indicated below.

IRB Approved:	02/06/2019 08:29:52 AM
Expiration:	02/06/2020
Review Category:	7

Waivers: Waiver of signature is granted on consent document.

If applicable, informed consent (and HIPAA research authorization) must be obtained from subjects or their legally authorized representatives and documented prior to research involvement. In addition, FERPA, PPRA, and other authorizations / agreements must be obtained, if needed. The IRB-approved consent form and process must be used. Any changes in the research (e.g., recruitment procedures, advertisements, enrollment numbers, etc.) or informed consent process must be approved by the IRB before they are implemented (except where necessary to eliminate apparent immediate hazards to subjects).

The approval will no longer be in effect on the date listed above as the IRB expiration date. A Periodic Review application must be approved within this interval to avoid expiration of the IRB approval and cessation of all research activities. All records relating to the research (including signed consent forms) must be retained and available for audit for at least three (3) years after the research has ended.

It is the responsibility of all investigators and research staff to promptly report to the Office of Research Compliance / IRB any serious, unexpected and related adverse and potential unanticipated problems involving risks to subjects or others.

This approval is issued under the Ohio University OHRP Federalwide Assurance #00000095. Please feel free to contact the Office of Research Compliance staff contact listed above with any questions or concerns.

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