2023

Teachers' Use of Game-Based Technology Assessment Tools in United Arab Emirates Middle Schools

Simone Saad
Walden University

Walden University

College of Education and Human Sciences

This is to certify that the doctoral study by

Simone Saad

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. Gina Solano, Committee Chairperson, Education Faculty
Dr. Sunddip Aguilar, Committee Member, Education Faculty
Dr. Cheryl Burleigh, University Reviewer, Education Faculty

Chief Academic Officer and Provost
Sue Subocz, Ph.D.

Walden University
2023

Abstract

Teachers' Use of Game-Based Technology Assessment Tools in United Arab Emirates Middle Schools

by

Simone Saad

MA, Walden University, 2008

BS, Huron University, 1999

Project Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Education

Walden University

May 2023

Abstract

Using technology in the 1:1 classroom has been a focus of scholars and has become the educational standard for many schools, especially those in the United Arab Emirates (UAE). However, researchers have demonstrated that even though access to laptops is no longer an issue in many schools, there remains low integration of engaging activities in the 1:1 classroom. The problem addressed in this study was the lack of adopting and incorporating game-based technology assessment tools at two middle schools in Abu Dhabi, UAE, both of which are 1:1 schools. The purpose of this basic qualitative project study was to better understand the use of game-based technology assessment tools and how teachers are implementing them at two Abu Dhabi middle schools. Data were collected through questionnaires and interviews where 27 middle school teachers provided their perceptions of implementing game-based technology assessment tools in 1:1 classrooms. The theory of self-efficacy and the technology acceptance model were used to interpret the data collected. The results of this study showed that teachers liked using game-based technologies, but they are not confident in using game-based technologies effectively because of lack of training. Most teacher participants requested a self-paced professional development program that could be completed with a group of peers. Therefore, the project to be developed is a self-paced online professional development course that could be completed in collaborative peer groups. This study has potential implications for positive social change by providing technology training to teachers to implement game-based assessment tools more effectively in the middle school classroom, which can lead to improved student engagement and increased learning outcomes.

Teachers' Use of Game-Based Technology Assessment Tools in United Arab Emirates Middle Schools

by

Simone Saad

MA, Walden University, 2008

BS, Huron University, 1999

Project Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Education

Walden University

May 2023

Dedication

I dedicate this project to my family and friends who supported me directly or indirectly, especially my wife Caroline for her endless love and support, and to my late dear friend Fahim K. Without your support, I could not have accomplished this uphill endeavor. Car-o you have known me since I first began my journey, you were my support and my toughest critic. Thank you!

Acknowledgments

I was blessed with an awesome mentor throughout the process of completing my project study, who influenced my journey. I would like to thank my committee: Dr. Gina Solano, Dr. Sunddip Aguilar, and university research reviewer Dr. Cheryl Burleigh. Their constant support, guidance, and tough love were crucial to seeing this project until the end. I am glad you all crossed my path allowing me to stay the course.

Table of Contents

Section 1: The Problem

The Local Problem

The era of technology has beckoned a change in the educational world. Most noticeable is the increase in the phenomenon of using digital games for formative assessments in teachers' lessons; games not only increase student engagement but also provide valuable formative assessment data for teachers (An & Cao, 2017; Educause, 2014; Kamişli, 2019). Adopting these game-based technology assessment tools as a teaching strategy can pose a great challenge in and out of the classroom for K–12 schools in the Middle East (Alsuhaymi & Alzebidi, 2019). The world is changing rapidly, forcing schools to become globally competitive in their methodologies of curating students proficient in 21st-century technological skills. Technology and computers offer ways of motivating students to learn about real-world issues and create deeper meanings of complex concepts (Cuban, 2001).

As such, educational technology tools are rapidly permeating schools in developed countries worldwide (Mårell-Olsson & Bergström, 2018). Many K–12 schools in developed countries, such as the United Arab Emirates (UAE), contain sufficient technology to provide each student with a laptop or Chromebook (Farid, 2021; Hamidi et al., 2011; Woodbridge, 2014). K–12 schools that provide each student with a technology device are referred to as one-to-one (1:1) because there is sufficient technology for every student at all times (Varier et al., 2017). In this study, the focus was on Palm Tree Middle School (PTMS) and Desert Sands Middle School (DSMS; pseudonyms). The purposeful selection of these two middle schools allowed for better participant anonymity and the

schools were representative cases for many schools in the Abu Dhabi region (see Creswell & Poth, 2018). “The primary purpose of sampling for a qualitative researcher is to collect specific cases, events, or actions that can clarify or deepen the researcher’s understanding about the phenomenon under study” (Ishak & Bakar, 2014, p. 29). Teachers in 1:1 schools are expected to be facilitators while using technology as they engage students with activities to promote higher-order thinking (Donovan et al., 2010). For teachers to lead students in the right direction, teachers need to be accepting and comfortable with the technology currently available in their schools. Unfortunately, not all K–12 schools in developed countries are equipped with the same technology or staffed with an entire faculty of technologically skilled educators (Schaffhauser, 2018). The lack of technological consistency in the classroom among developed schools may lead to other significant challenges.

The Local Problem

Despite the number of different types of technology available at 1:1 middle schools and the multiple efforts by school administration to provide technology professional development (PD), the problem of low integration of game-based technology assessment tools continues to persist. The following research questions guided this study:

RQ1: What are middle school teachers’ perceptions of game-based technology assessment tools?

RQ2: How are middle school teachers implementing game-based technology assessment tools during remote and face-to-face teaching?

Middle schools in the UAE include Grades 6–8 and are modern, technology-rich learning environments with access to several educational applications that engage students in a game format. Despite the instant access to technology, there remains a large gap between the few teachers taking advantage of these tech-tools and those teachers who are not (PTMS principal, personal communication, August 25, 2019). The isolation forced on teachers due to the COVID-19 pandemic severely limited opportunities to collaborate on best practices. The remote teaching experience in the UAE widened the gap between the teachers with technological skills and the unskilled teachers, which resulted in a decline in teaching quality using technology, with many teachers using only video conferencing tools and leaving out other important tools to improve engagement and assess student learning (Erfurth & Ridge, 2020).

Throughout the world during the COVID-19 pandemic, students experienced many deficits in learning because of the conversion to online and remote teaching. Teachers have reported not being prepared to teach online and experienced little success from students not participating in the virtual class, not turning in work, and not completing assessments to their expected abilities (Middleton, 2020). These challenges were also experienced in the UAE and, in particular, at PTMS and DSMS where this study took place. Teachers in 1:1 schools are expected to be facilitators of research-based best practices while using technology as they engage students with higher-order thinking skill activities (Donovan et al., 2010), yet there remains resistance to technology among the faculty at many of these technology-rich schools (Howard & Mozejko, 2015). This is also the case in several secondary schools in the UAE. Similar occurrences were

observed in the region by principals and school leadership teams, such as DSMS (DSMS senior leadership team, personal communication, October 23, 2019).

Teachers in two middle schools in the Abu Dhabi region are not properly using the approved game-based technology assessment tools, due to several barriers. Almekhlafi and Almeqdadi (2010) highlighted barriers, such as technical problems, overpopulated student classes, and lack of PD, training, and support, which hinder technology usage in classrooms. De Los Arcos et al. (2017) noted both a lack of reward or recognition and equally reciprocated collaboration with other teachers as additional barriers to technological uptake by teachers. Another barrier to the acceptance of technology and game-based technology assessment tools could be due to prevalent negative teacher and parent attitudes toward the impact of technology on teaching and learning, which are still evident among public and private schools in the UAE (vice principal at PTMS, personal communication, September 13, 2019).

Two middle schools, PTMS and DSMS, located in Abu Dhabi, were used as the focus of this study. Both these schools struggle with the gap between the few teachers who utilize game-based technology assessment tools and the majority who do not (DSMS academic vice principal, personal communication, September 13, 2019). Both PTMS and DSMS have a 26-to-1 student–teacher ratio and are equipped with the following: Chromebooks, laptops, interactive whiteboards, digital projectors with 4G connections, and Wi-Fi in every classroom. Although both schools are independent schools, they fall under the Ministry of Education of Abu Dhabi; thus, classroom sizes and equipment are similarly distributed. In-person and online training, professional learning communities,

and peer-to-peer collaboration time have been provided to all teachers at both schools to strengthen their game-based technology skills (DSMS senior leadership team, personal communication, October 23, 2019). To further assist educators in other middle schools as well, new educational program platforms that contain game-based technology assessment tools, such as the online differentiated learning platform Alef, the online formative classroom assessment tool Kahoot, and the online game-style formative assessment tool Quizlet, were introduced to enhance lessons, increase student engagement, and provide more options of formative assessments. Despite the small efforts of some teachers to incorporate these tools and digital games in their lessons, resistance from the overall faculty during training opportunities was apparent (PTMS principal, personal communication, September 13, 2019). Research has suggested that contributing factors for the low integration rate of technology include teachers' lack of confidence and self-efficacy in their technical skills and the low value teachers place on technology (Howard & Mozejko, 2015).

Shaping teachers' beliefs and interests to build their technological and pedagogical knowledge could be accomplished by exposing them to specific curricula supporting digital games (Dikmen & Demirer, 2016). For instance, technology-integrated activities could be implemented through the practice of modeling how specific games are used to build content knowledge. The administration at PTMS and DSMS approved and supported the use of Alef, Kahoot, and Quizlet, along with other technology tools. Despite access to these tools, faculty did not adopt them even during the COVID-19 pandemic. The hesitancy to use game-based technology assessment tools has shifted and

changed to be less of a priority while teaching remotely. However, due to the challenges of virtual teaching, educators needed to use game-based technology assessment tools. Also, educators needed to use assessment tools to promote engagement, reinforce content, and assess students formatively. Teachers should no longer allow their reluctance to hold them back from using these tools. Remote learning has pushed teachers into a situation where they must implement these tools (Boss & Krauss, 2008).

However, the high demand for teachers to use game-based technology assessment tools has resulted in significant teacher burnout and dissatisfaction (Pressley, 2021). COVID-19 has augmented teachers' struggles by making technology-based learning the pillar of education, contributing to a sentiment of survival mode among teachers, with a focus on providing basic lessons (PTMS principal, personal communication, April 14, 2021). Even though classroom observations and walkthroughs prior to this study indicated some teachers continued to use traditional lecture-style teaching, other teachers had begun initiating and piloting game-based technology assessment tools—Alef, Kahoot, and Quizlet—provided to them before the global pandemic (DSMS principal, personal communication, August 25, 2019). The problem addressed in this project study is the inconsistent use of game-based technology assessment tools within two Abu Dhabi middle schools. The incorporation of these game-based technology assessment tools into instructional practice was occurring at a slow and inconsistent pace.

The Ministry of Education (MOE) of Abu Dhabi decided to implement Alef Education in 10 public schools in the Abu Dhabi region. Alef Education (2021a) is a digital learning platform that provides personalized education to support student learning

alongside the existing curriculum. Educators from 10 schools were given access to a real-time digital database that provides access to lessons, games, assessments, and grading tools (MOE, 2021). By doing this, the MOE sought to provide both technological and educational content; foster student motivation to learn; provide space for creativity, critical thinking, thought analysis; and form conclusions that align with the curriculum and latest teaching methods (MOE, 2021). The Alef platform offers three main pillars that emphasize a fun and easy-to-use digital learning environment. The platform also encompasses high-quality hypermedia content developed to engage and stimulate learning with a blend of videos, interactive lessons, and games all linked to the MOE curriculum and learning outcomes across three grades (Grades 6–8). In addition, real-time data are provided with each lesson to enable educators to support personalized learning and identify student strengths and weaknesses.

Despite multiple efforts by the PTMS and DSMS senior leadership team, the problem of low integration of gamified technology tools continued to persist. Inconsistent use of technology was visible among several middle school teachers not implementing the tools into their instructional plans and activities (DSMS principal, personal communication, August 25, 2019). PTMS and DSMS administrators, as well as their respective teachers, needed new strategies to implement successful, competitive, and engaging technological tools to facilitate better instruction and student learning (PTMS senior leadership team member, personal communication, October 23, 2019).

Rationale

School leadership at PTMS and DSMS need to understand teachers' decisions whether and how they use the technology assessment tools in Alef Education, Kahoot, and Quizlet, approved educational digital games at PTMS and DSMS in the UAE (DSMS academic vice principal, personal communication, September 13, 2019; PTMS principal, personal communication, September 13, 2019). The aim of this study was to gather data from a purposeful sample of middle school teachers at PTMS and DTMS who teach in 1:1 classrooms and have access to and use game-based technology assessment tools. The purpose of this qualitative study was to understand teachers' perceptions of game-based technology assessment tools and the tools implementation. The results of this study could be used to help support the entire faculty to integrate more of these digital games for assessment purposes. In addition, the results could help school professionals facing similar challenges improve faculty technological and pedagogical knowledge to incorporate the use of new technologies. Lessons learned from the findings can also be used to strategize and implement supportive technology PD practices in the future. Technology is a remarkable tool, and teachers are expected to use technology in lesson planning (International Society for Technology Education [ISTE] Educator's Standards, 2018).

Some teachers view technology as a tool for responding to the various demands in teaching, work, communication, and connecting with the world. Devers (2015) mentioned that while game-based technology assessment tools adoption in the classroom is increasing, there is lacking extensive and definitive research to show that gamified

learning environments improve student learning outcomes. Similarly, Toyama (2015) and Landers (2014) agreed that solid instructional material is still a prerequisite to game-based technology assessment tools being successful. Research supports the need to focus primarily on nurturing good teachers who know when to gamify and how much to gamify. There remains a gap in research and data pertaining specifically to the investigation of teachers' perceptions of game-based technology assessment tools in teaching in the UAE.

Exploring the engagement of Alef Education (2020) and the use of other game-based technology assessment tools by teachers at PTMS and DSMS was the focus for this study. The findings of this study should provide a good representation of other middle schools in the region. There is an urgent need to understand teachers' hesitation to employ these game-based technology assessment tools in teaching at secondary schools so the quality of education can improve (PTMS academic vice principal, personal communication, April 14, 2021). COVID-19 highlighted the importance of game-based technology assessment tools. When entire curricula were shifted to online, the sudden transition to online teaching forced teachers to implement technology-based learning without any proper assistance and training. As such, I conducted this study seeking to support the seamless transition of game based-technology assessment tools for teachers. By understanding teachers' concerns, school administrators can provide the necessary assistance and training for a smoother transition toward game-based technology assessment tools.

In this research study, I sought to understand the learning gap among teachers in game-based technology assessment tools use. Likewise, discovering other factors that affect technology use in teaching will help improve teachers' acceptance of game-based technology assessment tools. The purpose of this study was to understand teachers' perceptions of game-based technology assessment tools and how they are implementing these tools at PTMS and DSMS in the Abu Dhabi region of the UAE.

Definition of Terms

Alef Education: A global education technology company based in the UAE. Alef Education is a digital learning platform that provides personalized education to support students' learning and customized curriculum, offers real-time data, and allows for parent participation (Alef Education, 2020). Both the terms *Alef* and *Alef Education* will be used interchangeably throughout the study.

Critical friend groups: Bring together several different teachers over the span of 2 years to support each other in their classes and make any necessary adjustments to their lessons. As such, teachers will continue assessing how to implement and achieve a game-based technology assessment tool learning environment.

Game-based technology assessment tools: Also called *digital games*, apps, or online activities a teacher creates to formatively assess students' understanding of content. The results of the games provide data for teachers so they can determine student comprehension. These types of games are typically used as a review activity during or after a lesson.

Kahoot: An online game-based technology assessment tool and learning platform that has been proven to demonstrate improvements in student engagement and reinforce learning.

One-to-one (1:1): Within this research, 1:1 reflects the ratio of technological devices to students in each classroom, where each student is provided with their own device: one web-enabled laptop or tablet device per student. This technology allows for more accessibility for all learners and stakeholders rather than confinement to traditional predecessors (Varier et al., 2017).

Technology acceptance model (TAM): A model for assessing technology use by adults and how they perceive and accept new technology and its implementation (Scherer et al., 2019).

Quizlet: An online digital tool through which teachers create their own formative assessments to boost student learning. Students are awarded points and compete against each other for the best score.

Significance of the Study

This research study was conducted to explore the learning gap and focus on understanding teachers' use of game-based technology assessment tools in 1:1 middle schools in the Abu Dhabi region, UAE. The results will benefit PTMS and DSMS, which are the focus schools of this project. Perspectives from teachers who have access to multiple game-based technology assessment tools, 1:1 classrooms, and who have participated in school technology training can lead to insights that can be shared with faculty in PD training who need to build their technical skills and improve their

pedagogical practices. The results from the study may help guide the creation and implementation of new game-based technology assessment tools programs at PTMS and DSMS and perhaps realign existing programs by finding the appropriate tools and support structures needed to ensure teachers' active use moving forward. Understanding how and why teachers adopt a specific type of technology is the first step in designing a successful PD program. This study is a steppingstone for positive social change in teachers' technological pedagogy in the UAE.

In a wider context, the results of this study may also benefit other secondary 1:1 schools in the Abu Dhabi region of UAE, by providing strategies to support the use and integration of gamified tools. Decision makers who plan school PD may be able to identify best practices for using game-based technology assessment tools. The results of this research may provide a positive social change for practitioners and administrators at PTMS and DSMS to support them in improving the use of game-based technology tools in faculty pedagogy when implementing formative assessments. This project could also be applied in schools with similar contexts that desire to provide support and programs to increase teachers' self-efficacy and technological and pedagogical knowledge in the use of game-based technology assessment tools, which can improve student engagement and classroom learning.

Research Questions

This basic qualitative project study was conducted to explore the gap in research and to focus on understanding teachers' use of game-based technology assessment tools in 1:1 middle schools in Abu Dhabi. The local problem is school administrators' concerns

that a majority of faculty at PTMS and DSMS are not using effective game-based technology assessment tools in their pedagogy. Students are not being actively engaged and teachers are not receiving important formative data from these digital games that could be used to improve instruction. The research questions were designed to understand the problem and to discover how those teachers using the game-based tools are implementing them:

RQ1: What are middle school teachers' perceptions about game-based technology assessment tools?

RQ2: How are middle school teachers implementing game-based technology tools during remote and face-to-face teaching?

Review of the Literature

The research problem includes extensive research of existing literature surrounding several key topics. These topics included the framework for this study, TAM, teachers' perceptions of technology, technology PD, student engagement and technology, and game-based technology assessment tools in education. Of these topics, an initial review of existing literature began with a focus on TAM because the conceptual framework was used to situate the research question in a larger existing theory. The Walden University Online Library was used to search peer-reviewed articles, as well as scholarly search engines, and articles written about TAM in a broader sense. To find accurate information, I narrowed searches down by searching for key terms from larger topics. For example, *TAM* in combination with *game-based technology tools, digital games, 1:1, student engagement,* and *teacher perception*. Combining a conceptual

framework with more focused key terms delivered a more analytical breadth of research from the last 5 years and provided a nuanced look at existing theory and study outcomes. In some circumstances, sources older than 5 years were included, as there does exist a slight gap in current research. Consequently, this permitted a well-balanced look at the evolution of technology integration in educational settings. The following review of literature will open with a summary of existing literature surrounding TAM followed by the intersections of my peripheral topics with TAM itself.

Conceptual Framework: Technology Acceptance Model

This study referred to TAM as a lens to understand the acceptance of game-based technology assessment tools at PTMS and DSMS. This model, originated by Davis (1989), has been used to understand how teachers perceive the usefulness of technology and how easy technology is to use to better understand how technology is used in the classroom. A teacher's use of technology depends on the degree to which the technology would improve their teaching effectiveness and how easy the technology is to use (Davis, 1989).

TAM has been supported by extensive research. Powers et al. (2020) used TAM to understand how teachers overcome their digital divide by transforming to a 1:1 platform. The participants reported that they adopted the technology because it was provided for them, but also because they believed it improves student engagement, provides individualized instruction, and improves teacher productivity. Similarly, Joo et al. (2018) investigated the relationships and intersections of the technological pedagogical and content knowledge (TPACK) model and teacher self-efficacy by

conducting an inquiry into preservice teachers' experiences in three different Korean universities using "structural equation modeling methods" (Joo et al., 2018, p. 48). Their close look at TAM and its intersections was useful to my study as it expands the reach of the conceptual framework for this project.

Joo et al. assessed the relationship between TPACK, and teacher self-efficacy based on TAM as a conceptual framework and found three significant findings. First, teachers' TPACK influences both their self-efficacy and perception surrounding the implementation of technology (Joo et al., 2018). Second, the researchers found teachers' use of TPACK to be directly correlated to their eagerness to make use of technology in their classrooms. Lastly, Joo et al. determined that teacher self-efficacy impacts teachers' intentions to use technology most strongly. TPACK was not a significant factor, overall, in their participants' "intention to use technology" (Joo et al., 2018, p. 48). Joo et al. confirmed previous research by showing that "perceived ease of use significantly affected perceived usefulness in TAM" (Joo et al., 2018, p. 56).

Building on Joo et al.'s (2018) research, Sánchez-Mena et al. (2019) focused on teachers' intention of using technology and the impact that intention has on outcomes. Like Joo et al., Sánchez-Mena et al. found that teachers' behavioral intention to use gamified technology in their classes is impacted by their perceived ease of use and perceived usefulness. Joo et al. and Sánchez-Mena et al. used quantitative structural equation modeling methodology that provided a contrast to the intended qualitative research methods, which was useful in helping me to commit to my own methodology. Sánchez-Mena et al. concluded that teacher training programs should focus on

"increasing teachers' perceived usefulness" (p. 318) of technology. As a result, the intention was to have content included in my interviews and questionnaires relating to teachers' PD relating to technology.

Lightsey (1999) highlighted Bandura's (1997) book *Self Efficacy* in its relevance to researchers in combination with TAM. Lightsey (1999) considered the exercise of control a remarkable attempt at the organization, distillation, and summarization of meaning from distinct literature that discussed how individuals are adopting technologies. The effect of self-efficacy beliefs on human behavior makes it a key factor in the understanding of human self-determination. The way an individual applies self-efficacy through experience, learning, and verbal persuasion is substantiated by Bandura along with the ability of modified self-efficacy to predict outcomes consistently. Lightsey (1999) noted that outcomes across several studies of diverse realms of human functioning have been strongly predicted by the self-efficacy beliefs of the individual, whereas most of the beliefs that are alternative and global have a relatively less consistent and weaker predictive ability, such as constraints from government, culture, or administrators.

The efficiency of collective self-efficacy in the improvement of the understanding, prediction, and measurement of the processes and outcomes of groups across various content areas is evidenced in a group's ability to accept and adapt to change (Lightsey, 1999). Self-efficacy theory can be used to understand the improvement in one's performance on a task or by successfully meeting a goal. When a person has strong self-efficacy and believes they can learn new skills, such as technology, this shows in their work (Lightsey, 1999). Understanding how to build a person's self-efficacy can

be a value to teachers, coaches, school administrators, vocational counselors, and researchers for designing instructional programs. Self-efficacy theory provides important insight when considered in conjunction with the principles of TAM, which explains a more astute look at teachers' acceptance and internalization of technological practices in the classroom.

Also focusing on the concept of teacher self-efficacy and the use of technology in the classroom, Dele-Ajayi et al. (2019) collected data from 220 teachers in Nigeria to determine which factors contribute most to teachers' decisions to incorporate gamified technology in their classrooms. This study makes use of similar research methods and provides an excellent contextualization of this research within a Nigerian context. While the UAE is unique from Nigeria, it is similarly an educational context where "technological interventions have not been used before" (Dele-Ajayi et al., 2019, p. 1). For this reason, Dele-Ajayi et al.'s (2019) findings that both perceived usefulness and self-efficacy are among the most "significant predictors of the intention of teachers to adopt digital game-based learning in the classroom" (p. 1) are significant to this research.

Further indication that TAM and teacher self-efficacy are intricately linked is the study carried out by Lestari and Indrasari (2019). The researchers examined the efficiency of iPads for teacher instruction and its perceived impact using TAM as the conceptual framework. Using qualitative study methods, Lestari and Indrasari examined the perceived impact and efficacy in the classroom to predict the adoption or acceptance of iPads by teachers. The participants were 91 teachers who used an iPad in their classrooms for a minimum period of 3 months. Teachers' abilities to use the iPad were

measured by rating themselves on given scales. The results of the study indicate that the efficacy of teachers played a significant role in predicting their actual use of an iPad; however, the perceived impact of the employment of an iPad in a classroom does not affect the predictability of the use of an iPad (Lestari 2019). The study provides useful information about the importance of an educator's self-efficacy when expected to adopt new technology. Teachers who believe they had the ability to integrate iPads showed more integration of them (Lestari, 2019). This study provides further evidence for my own research that using TAM as a lens to analyze my data is necessary with strong consideration to teacher self-efficacy.

The conceptual framework for this study followed TAM, which indicates how teachers accept and use technology in their pedagogy (Scherer et al., 2019). This model focuses on the variables: motivation, ease of use, perceived usefulness, attitudes toward technology, teacher self-efficacy and other behavioral variables. The model describes the intentions of using technology and the actual use of technologies to support the teaching and learning process. Simply put, the most key factors are the degrees to which a person believes using technology would be free from effort and that incorporating technology would improve job performance. This model is supported by Bandura's (1997) self-efficacy theory, which draws on both the cognitive and behavioral factors that influence teachers' pedagogy. The application of TAM provided a lens to help assist me in identifying the ways teachers are successfully using technology in their classrooms.

Importance of Teachers' Perceptions of Technology

As this study centers around teachers' experiences with implementing game-based technology assessment tools in their classrooms, it was important to identify existing literature and research surrounding teachers' perceptions of technology. Examining the existing literature allowed more focus in this research on any gaps that may have existed and situated the content of the questionnaire within larger research focuses. First, Alenezi (2017) detailed obstacles in the use of technology in classrooms and categorized them into two groups. The first category of obstacles consisted of PD, technical support, access to resources, and time. The second category of obstacles included self-efficacy and risk taking. The researcher examined the obstacles identified by teachers when integrating technology with instruction. The purpose of the study was to understand the factors that contribute to the disconnect between technology and education and the belief that the use of technology is imperative in classrooms (Alenezi, 2017). The participants were eight teachers divided into two groups: exemplar models, who encouraged their students to use technology in classrooms, and typical models, who did not engage with technology regularly. The findings of the study suggest a disparity in the obstacles between exemplary and typical teachers. The obstacles felt by high-achieving teachers were considered high-level concerns. These obstacles were a lack of resources, policies, and security restrictions, while more typical obstacles included a lack of time to prepare resources. Impediments in managing technology were reported to contribute to a loss of instructional time. The participants from the typical group also commented on their discomfort in using technology and their low self-efficacy. This

study highlighted the various obstacles experienced concerning the employment of technology in classrooms by teachers who had contrasting familiarity with technology providing useful context and background for this study.

Building upon this research but with a more focused participant group, Carver (2016) explored the perceptions of K–12 teachers about technology's benefits and barriers. The participants included 68 teachers who completed an online questionnaire regarding their thoughts, experiences, and reflections on the use of technology in the classroom. Data were analyzed through open and axial coding, where Carver identified themes about the barriers and benefits of technology use with teachers and students. The identification of several factors was possible due to the open-ended format of the research questions. Carver's results indicated that the most frequently identified barrier was the availability of technology for both students and teachers, despite an emphasis on the provision of 1:1 devices. Although the skill and knowledge of teachers regarding technology were identified as a concern, they were small compared to the lack of technological availability (Carver, 2016). Among the benefits associated with the technology used in classrooms, the increased engagement of students ranked as the most frequently identified benefit. The results of this study show how effective incorporation and employment of technology for education and teaching can increase engagement.

Heath (2017) carried out a 2-year qualitative study to examine the beliefs of teachers when initiating a 1:1 technology program in the classroom. The results of the study suggest that positive beliefs about technology were central to participants' shared experiences during the conception and implementation of the technology program. Heath

concluded that the confluence of complex factors of the positive beliefs held by teachers regarding technology and their professional teaching agency played a significant role in crossing the technology barrier for teachers.

Howard and Mozejko (2015) studied the effects of changes in educational technology-related policies on teaching and learning, arguably resulting in minimal improvement. This study suggests that the culture of change increases the disengagement of teachers, resulting in a misconstrued image of teachers. Howard and Mozejko highlighted three key factors that were demonstrated as significantly affecting teachers' use of digital technology: leadership, a shared group vision, and technical and pedagogical support. The researchers discussed the importance of future technology integration and its dynamic nature, which would make it imperative for teachers to adapt to the changing and advancing technologies in their schools. However, taking into consideration the legitimate concerns of teachers about the lack of technological support, they must be open to risk taking and be willing to change to integrate technology that supports the learning process. In doing so, teachers must be supported by their schools when trying to learn and use new forms of technology. Interacting with this research provided me with the context needed to create questions for my participants that properly outline some existing concerns they may have.

Following this line of research around existing teacher concerns and their impact on teachers implementing technology in their classrooms, Dube (2017) focused specifically on higher-education teacher hesitations towards teaching in a 'blended' capacity in South Africa. Using TAM as the lens for a qualitative study, Dube concluded

that teacher concerns center largely around whether the technology will bring obvious added value and the amount of obvious "challenges of successful implementation" (p. 150). Most useful to my study was the concluding remarks of this research, which outlined teacher recommendations for improving their comfort with technology. These included "improved infrastructure, management support, and incentives for motivating educators" (Dube, 2017, p.150).

In a similar study seeking to understand teacher's fears in using technological innovations in their lessons, Marti-Parreño et al. (2016) examined teachers' willingness to use educational video games in the classroom. Using TAM as a conceptual framework, they used structural equation modeling to determine factors such as perceived usefulness and ease of implementation, similar to Sánchez-Mena et al. (2019). They concluded by submitting that the most valuable way to increase teachers' willingness to make use of technological innovations is to provide teacher training programs so that they may "realize the usefulness … rather than focusing on the level of easiness" (Sánchez-Mena, 2019, p. 434).

Çoklar et al. (2016), completed a qualitative study about the reasons contributing to "technostress" among teachers who were asked to include technology as a part of their teaching methods. The sample included 64 teachers, chosen through maximum variation sampling. The participants completed interviews and answered open-ended questions on the Technostress Level Determination Form. Data analysis was carried out through the use of program NVivo8 and thematic analysis. The results of the study indicated that five main reasons contributed to technostress: individual problems, technical problems,

education-oriented problems, time-related problems, and health problems. The findings also demonstrated a difference in the distribution of reasons for the stress in terms of gender, with female teachers reporting having more problems in the technology category, and male teachers experiencing more individual problems. Çoklar et al. concluded that the "technostress" experiences by teachers may be positively reduced through the social support of their colleagues.

In examining this literature and research, it was found that teachers' perceptions of technology and their intention to incorporate it in their classrooms is impacted by a myriad of factors. Alenezi (2017) cited PD, technical support, self-efficacy, and risk-taking as predominant factors while Carver (2016) noted the availability of technology as the most significant. Heath (2017) introduced the factor of teachers' pre-existing positive beliefs about technology and Marti-Parreño et al. (2016) agreed, listing teachers' existing beliefs about usefulness and ease of implementation as significant factors. Dube (2017) listed infrastructure and management while Mozejko (2015) outlined technical and pedagogical support in combination with the impact of leadership as crucial factors. Finally, Çoklar et al. (2016) used the umbrella term of "technostress" to describe factors such as individual and technical issues with technology, pedagogical concerns, time constraints, and health issues as pivotal factors influencing teachers' perceptions of technology. This broad collection is particularly useful to my study as it provides an open range of factors from which to craft my questionnaire questions.

Technology Professional Development

Given the identification of PD as a significant factor influencing teachers' willingness to use technology, this study investigates further the implications of technology PD in order to situate my study in a way that adequately addresses this significant factor. Cuban (2006) detailed the concerns of computers and technology within classrooms. The author argued that despite the developments in technology, classrooms continued to operate traditionally if the teachers were not included in the decisions regarding the integration of technology and its contribution to reshaping schools. The book's context was a mix of elementary, secondary, and universities in Silicon Valley that showed how teachers and students were using classroom technologies far less compared to their personal use of technology at home. Although the use of computers in the classroom by teachers was not completely absent, it was infrequent and unimaginative. The influence of historic and organizational economic contexts on the use of technology and its new developments by teachers was addressed by the author. The book established that the use of computers in classrooms could be beneficial when the teachers' technology skills were sufficient to enhance the learning experience for students and used to shape the curriculum. However, Cuban concluded by pointing out that apart from teacher training, there needed to be a better dedication to technology use in public education.

Frazier and Trekles (2018) carried out a study to examine the success and struggles associated with the use of iPads in classrooms in relation to the technology PD offered by the school's facilitators. The mixed-method case study examined the 1:1

adoption of iPads by elementary teachers. The participant sample included 26 teachers. Data was collected through focus groups that involved two teachers from each grade who participated in technology PD sessions. The data were collected at three different points throughout the year through questionnaires and observations about the perceptions and views of the teachers regarding the use of iPads in their teaching, management, assessment, and inquiry-based learning activities. Analysis of the data led to the identification of the teachers' perceived struggles from integrating iPads in their classrooms as well as the perceived benefits from the technological integration. The struggles included a lack of PD, technical issues, poor planning, and decisions by the administration. The successful aspects of the iPads were observed in the ability to differentiate instruction and improvement in student learning. The results also indicated that 1:1 integration must not be rushed, especially for younger, elementary-level students who tend to get distracted by iPads and could take part in cyberbullying or visiting inappropriate websites. This study highlighted the struggles of technological integration with little to no PD for how to use them. Even though the benefits of the iPads outweighed the negatives, the need for quality technology PD was evident.

Harrell and Bynum (2018) discussed the factors affecting the integration of technology in K-12 schools. This study categorized the integration factors into internal and external. The external factors included poor infrastructure, inadequate technology, inefficient technological tools, and inefficient PD. Internal factors included low self-efficacy among teachers coupled with their negative perceptions of technology use. The paper addressed the significance of knowing how to manage technology to employ it

effectively in the educational system. The results of their study pointed to discrepancies in usage due to the implementation of technology without additional support. In short, simply providing the technology in isolation did nothing to encourage its consistent usage. Self-efficacy was an important factor influencing the desire to use technology in classrooms, making it important for the teachers to be motivated and supported. The lack of confidence among teachers concerning the use of technological tools resulted in a reduced value of technology in the perception of teachers. Harrell and Bynum (2018) concluded by addressing the necessity of conducting a longitudinal study to determine the efficiency of the tools used, which would facilitate the construction of a reliable plan to help the schools and education systems address the internal and external barriers as a positive step in the direction of eliminating the gap between effective and ineffective uses of technology in education.

Lawless and Pellegrino (2007) discussed the role of PD for improved technology integration in the classroom. This article presented a systematic evaluation plan that was used to collect information that would contribute to a clearer understanding of the problems related to technology integration in the classroom. The evaluation design was presented in three phases, the first focused on the quality and types of PD opportunities. The second focused on the teacher outcomes of the PD. The third focused on the changes in teachers over the course of time and the effects of PD on the achievement of students. The authors concluded that the evaluation plan proposed could potentially provide a wide range of relevant information to address the lack of quality technology PD. It included

information related to improving technology integration in education that could affect better achievements in teaching and learning.

Martin et al. (2010) discussed the results of an instructional technology PD program. Their study included a thorough evaluation of the school district's PD to determine the associations among program variations and teacher outcomes to determine its impact on student achievement. The data was collected from three different groups: those who prepared the PD, the teachers who participated, and the students who eventually used it. The results of the evaluation indicated that by providing consistent technology, PD resulted in high-quality, technology-rich lessons by the teachers who participated in the program. These teachers also showed greater student achievement. It was noted that teachers who scored high in the PD assessments were able to have a better understanding of the technology program's concepts. The application of a quality PD program that is well attended by teachers, along with its practical employment in school districts, evidenced that the integration of consistent instructional-technology PD in schools can likely yield a positive outcome for student learning. Most importantly was the ongoing technology PD that provided a community of learners with the support they needed to successfully integrate new technology tools into their teaching.

Student Engagement and Technology

Although my study focused on teachers' experiences of technology in the classroom, the experiences of students with technology in the classroom and its peripheral application to my research are important for the well-roundedness it will lend to my questionnaire question formation. Maintaining student engagement is extremely

important to ensure that students are on task and learning. Technology, when used correctly, can reinforce learning as well as engage students.

Bergstrom and Mårell-Olsson (2018) studied the student perceptions of teachers' diverse didactical designs (how different environments, resources, and media are used for learning) of lessons in the 1:1 computing classroom. Primarily, it studied the students' perceptions in three different settings, all with 1:1 technology. These settings included traditional classroom environments where the teacher was the primary decision-maker, mixed classroom environments where the students were involved in decision-making processes, and flipped class environments where the students made the majority of decisions. Bergstrom and Mårell-Olsson suggested that diverse interactions between teachers and students occurred depending on their location and how teachers were using technology. They gathered empirical data based on student group interviews and highlighted the approaches of stimulated remembrance where 23 teachers' lectures were documented through classroom observations and photographs.

The researchers collected data from focus groups and obtained permission from the parents to conduct student interviews. They primarily evaluated students in the 2nd, 5th, and 7th grades (Bergstrom & Mårell-Olsson, 2018). The researchers identified three significant themes for students' technology use: how they learned in class, out of the class, and during classroom assessments. The data was then compared to the use of power and control in relation to student decision-making processes (Bergstrom & Mårell-Olsson, 2018). Students used technology to collaborate more often with their teachers, which showed how the power dynamics between them were altered through the increase

in cloud-based communication. Also, the data indicated that the technology gave students the power to select the content of what they wanted to learn, which also demonstrated a shift in the control of the learning. Students became a part of the decision-making process in their learning, which resulted in higher engagement. The 1:1 computing, and the student-centered curriculum design became the main element for making students' learning processes engaging.

Alaswad and Nadolny (2015) explored the process of the engagement of game-based learning and the instructional design approach. The purpose of their study was to understand how technology game-based learning was essential. Alaswald and Nadolny primarily investigated the process of designing a course as a game and the technological tools used to enable game-based learning. They demonstrated that technology-aided instructors provide appropriate and timely feedback to students. Also, the researchers stated that technology provided meticulous access to knowledge for both learners and instructors; therefore, both teachers and students benefited from the use of gaming technologies. The researchers concluded that essential attributes, such as providing feedback, having clear and attainable goals, and incorporating interaction among game-based learning, can enhance self-efficacy and promote positive learning experiences. They indicated that instant feedback is an essential factor in instructional games. Additional motivational techniques that proved beneficial were the use of badges and leaderboards. The researchers indicated that it was important to recognize the range of traits that can make an active learning experience (game design, timely feedback, badges, leaderboards, etc.). The results of the study indicated that a course with game-based

learning was a powerful way to engage and inspire students to accomplish learning goals (Alaswad & Nadolny, 2015).

Donovan et al. (2010) studied the configurations and challenges of laptop use and implementation in a 1:1 middle school environment. Although this study was completed over a decade ago, it is one of the few that directly focus on 1:1 technology implementation in middle schools. The researchers reported significant student off-task behavior in the classroom. They indicated that increased access to technology does not necessarily lead to increased engagement and productivity in the middle school setting. Donovan et al. concluded their study by stating that advanced access to technology often upsurges enthusiasm to use the technology, but it does not associate it with uses for academic purposes. Furthermore, this study stated that while implementing 1:1 computing in a middle school, it was significant to know the student population (demographics and learning styles) as well as consider learning goals, teachers' technology skills, and school environments (Donovan et al., 2010).

Meehan and Salmun (2016) studied student perspectives on integrating technology in undergraduate science courses. The purpose of their research was to evaluate students' satisfaction with engaging technology tools utilized during the course. Participants in this project evaluated the use of PowerPoints, digital projectors, interactive whiteboards, the online learning management system (LMS), and personal response units. The technology that received the lowest satisfaction was the online LMS as students reported preferring the slow pace of the overhead projector to keep up with their notetaking and understanding during the lessons. Also, the personal response units

received low ratings and were considered unproductive, their use unengaging, and their execution considered ineffective. The participants' highest technology satisfaction was when the instructors used a tool in a sound pedagogical manner that engaged students, such as a multimedia presentation. The participants recommended that more focus should be given to the pedagogical training of teaching staff, especially in disciples that traditionally do not require pedagogical coursework to be a professor. Also, the students recommended the need to include student-centered approaches in academic coursework in higher education. Meehan and Salmun concluded that the positive or negative satisfaction of students was based on the pedagogical methods and skill of the instructor who determined how engaging and productive a technology tool was, rather than just using the tool itself. Put simply, teachers' attitudes towards the technology tool greatly impacted the students' satisfaction with the tool itself.

Focusing specifically on game-based learning technology used by young learners, Lin and Hou (20106) sought to fill a research gap on young children's experiences with educational technology. Using mixed-methods, they looked at student experiences with a scenario-based, digital, mathematics game. They concluded that not only did the use of this game have a positive effect on their ability to learn strategies like route planning, but that students "demonstrated high technology acceptance" (Lin & Hou, 2016, p. 1967) towards the game. This finding was significant because it provided context to the importance of integrating technology into our classrooms and enlightened my research to include this factor when creating my line of questioning to participants.

Rizvi (2018) reported on how the classroom setup in Abu Dhabi has changed with the introduction of technology. He stated that with the integration of technology in the classroom, through the integration of the Alef Education platform (an online personalized curriculum software program), an interactive calendar, iPads, and digital avatars, the classroom setting had changed into a more interactive learning environment. The Alef Education (2021) platform, which included lessons, videos, and even educational games, was used in schools from grades six to eight in various subjects such as Science, Arabic, Math, and English. The Alef Education system used artificial intelligence to assess each student to differentiate their learning by determining their levels in each subject area. The Alef digital curriculum provided engaging lessons, immediate student feedback, and provided teachers with instant data about each student's performance. The students who used Alef showed a positive response and an increase in their learning outcomes. Rizvi (2021) indicated that innovative technology increased students' confidence levels. The researcher concluded that the implementation of Alef created a positive impact on learning.

This collection of research provided a wide range of student experiences to consider when formulating my questions for participants. Bergstrom and Mårell-Olsson (2018) concluded that student perceptions were positive, noting that technology allowed for enhanced student-teacher collaboration. Donovan et al. (2010), however, disagreed. Their research found that increased technology in the classroom is not synonymous with increased student engagement, citing that technology was often a distraction in class. Meehan and Salmun (2016) identified students' most and least preferred technology and

outlined that student satisfaction with technology is intricately linked to their teachers' attitude towards the technology. Most significant for the purposes of my research were the findings of Rizvi (2018) as it was focused within the same geographical and educational context my research intended to be. The research found Alef Education to be highly satisfactory for students with a positive overall impact on learning. These findings on students' experiences and perceptions of technology informed my question formation for the online open-ended questionnaire.

Game-Based Technology Assessment Tools in Education

As there are many applications of technology in the classroom, the research questions developed were specifically focused on the implementation of game-based technology assessment tools in the classroom environment. Licorish et al. (2018) evaluated students' perception of Kahoot's influence on teaching and learning in a qualitative study. This study focused more on the role of the game-based student response system (GSRS) on student engagement, learning, and motivation. These researchers distinguished game-based education as an academic method in which games are used to attain educational results through related learning and game-based assessment methods. Licorish et al. found that GSRS increased students' engagement, and improved classroom dynamics, and the entire learning experience. They discovered that Kahoot improved the quality of learning in the classroom, and it further portrayed that it enhanced classroom engagement and learning. The participants revealed that the earlier use of learning games did not bring a large impact on motivation and engagement. Technology game-based learning, such as Kahoot and Socrative, allowed a noticeable change in students'

engagement. Furthermore, Licorish et al. indicated how Kahoot used social media to permit students and teachers to be able to create and exchange content with one another. Also, the researchers discovered that the use of educational games diminished distractions and off-task behaviors in the classroom. This resulted in an enhanced quality of instruction and learning beyond a traditional classroom setting.

Bicen and Kocakoyun's (2018) study also explored students' perception of game-based technology assessment tools using Kahoot. In this study, Early Childhood Education majors' viewpoints on game-based technology assessment tools were questionnaires to analyze the best application of technology-based games, the environment that was essential for its practice, and the method by which the application continued to be used in higher education. This mixed-method study used an intra-class competition to find the effect of a game-based technology assessment tools approach on their achievement. The results showed that the utilization of a digital assessment game enhanced the interest of students in the class and at the same time it increased student motivations for success. During the use of the game, the students collaborated to reinforce their learning. Bicen and Kocakoyun (2018) explained how digital assessment games can improve the relationship between students. They also showed various ways in which students were motivated through earning badges, achievements, and rewards. Furthermore, game-based technology assessment tools and the use of Kahoot as a formative assessment helped students to practice their lessons in a better way. Students' perception of digital assessment games was that they created self-confidence, enabled

them to learn difficult topics easier, and more importantly, students enjoyed the learning process.

Robson et al. (2015) studied the principles of game-based technology assessment tools and apps, how they were defined, and their functions. The study also reviewed digital educational games in professional contexts and indicated that digital games were used in diverse ways like government, healthcare, transportation, sustainability, and in other fields for educational and motivational purposes. The researchers explored various ways to plan, implement, manage, and enhance game-based strategies in academic research and organizational practices. They defined how gaming experiences can be formed through primary principles such as mechanics, dynamics, and emotions. They stated that to create an effective framework for the use of game-based technology assessment tools, researchers need to consider the roles of players, viewers, game designers, and observers, and how each group impacts the creation, use, and evaluation of a game. Robson et al. used game-based pedagogy to create experiences that encouraged and engrossed individuals in non-game contexts. For example, American Idol used spectator voting to shift from a traditional television show approach to a significant cultural phenomenon that espoused not only the participants but also an entire nation of spectators.

Shiue et al. (2007) looked at online games and their impact on classroom collaboration by examining a digital history game. The results of their study concluded that this specific game-based learning environment increased collaboration amongst students and increased openness to future collaboration. This is in line with the findings

of Bergstrom and Mårell-Olsson (2018) who listed increased classroom collaboration, albeit between student and teacher, because of incorporating game-based technology assessment tools.

The research concludes, undeniably, that game-based technology assessment tools are an important positive force leading to increased student engagement and motivation (Bicen & Kocakoyun, 2018; Licorish et al., 2018) and increased classroom collaboration (Bergstrom & Mårell-Olsson, 2018; Shiue et al., 2007). These findings confirm that my research regarding teachers' perceptions of the use of game-based technology assessment tools is needed. Understanding teachers' thoughts, experiences, and attitudes towards game-based technology assessment tools has a high value in determining which ways we may encourage further implementation.

Research conducted by Kamışlı (2019) indicated the need for teachers to have more in-depth PD related to game-based learning and the implementation of educational games within the classroom. The study utilized a questionnaire research design which consisted of asking open-ended questions to four hundred and ten primary school teachers. Kamisli concluded and found a relationship with previous studies from Nousiainen et al. (2018) that, "On the surveys, teachers felt that they need training in the peculiarities of game-based learning approaches, application examples, course planning, course implementation, and evaluation processes" (p. 294). In the end, Kamisli suggested that the implementation of proper teacher training programs related to the use of game-based learning approaches may assist teachers' feeling incompetent even though they embrace game-based learning and educational games.

Alsuhaymi and Alzebidi (2019) bring to light barriers regarding utilizing digital games in teaching practice. The researchers used interviews at a Saudi public school to answer the following two research questions:

What are teachers' perceptions regarding using video games for educational purposes?

What are the barriers to the adoption of digital games in Saudi schools from Saudi teachers' perspectives?

The interview included and consisted of an all-male population of 22 middle and high school computer teachers, face-to-face. Alsuhaymi and Alzebidi mentioned that "participants agreed that video games were useful for enhancing student learning and enriching the learning environment" (Alsuhaymi & Alzebidi, 2019, p. 65). Even though the participants understood the benefits of embracing video games in their classrooms, it was mentioned that their colleagues were not fully aware of the benefits. On top of that, the teachers in the study stated that they have never tried implementing video games for teaching purposes. The researchers also found that the following barriers seemed to affect the perceptions of the teachers regarding video games: lack of facilitating conditions, low awareness of video games' potential for learning, and the lack of video games that suit Saudi peculiarities and curricula.

Impact of COVID-19 on Remote Teaching and Learning in the UAE

According to Middleton (2020), the validity of assessment scores and student achievement became an issue when COVID-19 impacted the school system. Across the board, educational institutions switched to online learning without any preparation or

adequate resources thus intensifying assessment issues. COVID-19 impacted education in various ways, particularly in the way teachers taught and approached their lessons compared to previous methods. Differences in methods and strategies occurred due to "a lack of knowledge of evidence-based pedagogical approaches to teaching online, lack of knowledge of technology, family/personal issues, illness, and various other reasons" (p.42). As Middleton mentioned, the quick and abrupt shift from in-person instruction to online instruction caused a shift in learning for students. With that in mind, Middleton implemented that if not addressed, a ripple effect could occur into the following school year that may hinder students' learning even further.

Erfurth and Ridge (2020) studied the impact of COVID-19 on the public and private school systems in the United Arab Emirates. An online open and closed-ended question questionnaire was emailed and sent to a total of 700 participants consisting of students, parents, teachers, and administrators. The following information was gathered, even though little training was received participants felt well-prepared for distance learning. On the contrary, concerns for students with learning disabilities seemed to come to light. Researchers also gathered that educators and students felt more stressed throughout the school day. Along the same lines, parents from low socioeconomic backgrounds felt stress from having to work while also caring for their children and supporting their learning at home. As a result, recommendations for more flexibility, prioritizing support for vulnerable groups, encouraging parental involvement, and incorporation of prepared learning kits were suggested.

Aldarayseh (2020) brings to the forefront how the COVID-19 pandemic has impacted learning as it relates to science classrooms in the United Arab Emirates. The qualitative research study explored the perceptions of 62 male and female public as well as private school science teachers within different emirates of the UAE. Perceptions of the teachers varied when questioned on traditional, online, and blended learning classroom learning. The challenges of initiating students in hands-on activities and the lack of science teachers' competencies in fostering interaction in the online classroom were of concern to the science teachers. Aldarayseh (2020) suggested that the Ministry of Education (MOE) evaluates the teaching of science online and offers science teacher training regarding the inclusion of interactive tools that their teachers can utilize for online learning.

Implications

The findings of this qualitative project study were pertinent in identifying the perceptions held by teachers which contributed to their usage of technological tools provided at PTMS and DSMS in Abu Dhabi. The findings from this study identified that the faculty found value in the game-based assessment tools and liked using them with their lessons, but they need PD that can be completed with their peers on their own time. The project created for this study was an online technology PD course that could be completed by faculty cohorts at each school. The online PD was designed to provide in-depth instruction on the three game-based tools from this study. The online PD course will be exceptionally useful and may contribute to positive social change for the faculty and school leaders at PTMS and DSMS, as well as at other schools with similar contexts.

Educational stakeholders including, but not limited to curriculum and instructional developers, researchers and educational managers and leaders, IT developers, school instructors and teachers, education students, and MOE personnel, could also benefit from providing online, faculty learning community PD to support teachers at their 1:1 schools. This study could directly influence current technology PD efforts to better meet the needs of teachers who are expected to utilize the approved game-based technology assessment tools approved by the government (Nasir, 2019).

The review of literature focused on key topics including student-teacher engagement, the effectiveness of a 1:1 classroom environment, technology PD, and the use of game-based technology assessment tools in teaching. The conceptual framework for this study, Technology Acceptance Model, was utilized by Powers et al. (2020), who used predominantly qualitative methods in their mixed methods to study the implementation of technology in a 1:1 school. The literature reviewed in this study builds on the work of studies that utilized TAM (Joo, 2018; Powers, 2020; Sherer et al., 2019) to understand how teachers' perceptions and opinions affect their technology acceptance.

Furthermore, this study may act as an excellent resource for curriculum and instructional developers to consider the perceptions, attitudes, and abilities held by teachers, which significantly contribute to the rate of usage of their new gamified technology-based programs. This could manifest itself in more thorough PD sessions and tutorials, or perhaps even just more user-friendly technology. This study could benefit teachers by understanding the best ways to develop their technology skills.

Finally, an additional project that could result from this research could include a technology PD program that provides teachers with the type of support and instruction focused on developing their technology skills. A multiple-day workshop could be organized to teach instructors how to use a variety of approved game-based technology assessment tools. The findings from this basic qualitative research project have been used for the purpose of designing workshops. Another possible project that could result from this study is an article to submit for publication in a peer-reviewed journal. This study could contribute to the gap in research regarding instructors' resistance towards game-based technology assessment tools and provide administrators with suggestions for ways to structure their technology PD sessions.

Summary

The purpose of this study was to better understand the use of game-based technology assessment tools, and how they are implemented at PTMS and DSMS in the Abu Dhabi region of the UAE. The recent modernization of education has centered on the importance of two factors; the integration of technology in lessons and game-based technology assessment tools in the classroom to reinforce learning objectives. Furthermore, the PD that teachers receive is an important factor that can indicate the implementation of game-based technology assessment tools. Thus, the use of game-based technology assessment tools has been shown to increase student engagement and provide teachers with valuable formative assessment data.

In Section 2, the study's methodology, research implications, research design, data analysis, and limitations will be explained. The next section will explain why this

study used a basic qualitative methodology as well as details about the participants. This section will also describe the data collection tool and how the data will be analyzed and then conclude with the limitations of the study.

Section 2: The Methodology

Research Design and Approach

I used a basic qualitative design for this project study (see Appendix A). As my problem and research questions revolved specifically around understanding human behavior—teachers' perceptions and experiences of game-based technology assessment tools—the research design needed to allow my participants to provide me with in-depth information regarding their thoughts and experiences (see Merriam & Tisdell, 2016). As such, a basic qualitative research design was used to understand teachers' experiences using Alef, Kahoot, and Quizlet; I sought their opinions of these tools and how to support them in using the technology more effectively. In a qualitative study, a researcher is able to make observations and engage with the participants in an authentic setting to gather data (Creswell & Poth, 2018). I chose online open-ended questionnaires and interviews to gather data to answer the research questions. Questionnaires and interviews were equally distributed between PTMS and DSMS.

A basic qualitative study suited my research focus much more effectively than other qualitative approaches because my intent was to understand teachers' perspectives at PTMS and DSMS. According to Merriam (2009) and Kahlke (2014), a basic qualitative study can be used as a researcher's specific approach to the study. Because my study did not fit within the bounds of other common types of qualitative research methodology and my overall purpose was to gain a better understanding of the problem, following a basic qualitative approach was the best method for this project (see Kahlke, 2014). The basic inquiry approach enabled me to better understand the teachers who have

1:1 technology access as well as multiple game-based technology assessment tools and how they are being utilized. The qualitative approach utilizes the T3 research for research and assessment purposes and examines how technology is used by teachers, especially how teachers are implementing these technologies into their classrooms.

I did not use the grounded theory approach for this study because the purpose of this project was to discover better strategies for providing technology PD and not to construct a theory from data (see Creswell, 2013). Likewise, ethnographic research did not support my research goals because I was not seeking to understand the shared patterns of a cultural group (see Creswell, 2013). A basic qualitative design (see Creswell & Poth, 2018) allowed me to develop a focused understanding of teachers' firsthand experiences with game-based technology assessment tools in the classroom.

Participants

My research hinged upon the depth of information received from each participant. As such, all the teachers at PTMS and DSMS were invited to participate. Creswell and Poth (2018) outlined that qualitative research design is best supported by a small sampling size because after a sufficient sample size is reached, the data is repetitive. There were 32 teacher participants who completed the questionnaire, and I conducted four interviews, which provided enough data to reach the depth of inquiry needed to answer the research questions. Data saturation for the questionnaire was reached after 25 participants; for the interviews, data saturation was reached after the first two out of total four interviews conducted. I used an online open-ended digital questionnaire as well as an interview protocol to gather data. I used purposeful and convenience sampling to blend

both the need for abundant information from each participant and to be considerate of the health concerns due to COVID-19 restrictions that did not allow for face-to-face interactions (see Creswell & Poth, 2018)

Criteria for Selecting Participants

The criteria for selecting participants were that the teachers needed to have attempted to use any of the three game-based technology tools while teaching remotely during the pandemic. The participants also needed to work at either PTMS or DSMS for the purpose of convenient sampling; these two schools support the use of all three game-based assessment tools. Finally, the participants had to be middle school teachers in the Abu Dhabi region due to it being the educational context for this study, as approved by the Walden University Institutional Review Board (IRB).

Procedure for Gaining Access to Participants

Prior to beginning data collection, I contacted the principals at PTMS and DSMS (see Appendix B) to receive permission to conduct my study at their schools. Each principal provided consent, which was essential in receiving my IRB approval (#10-01-21-0039176) that gave me permission to contact teachers and collect data. Currently, I work at a different school in Dubai, so there was no pressure placed upon the teachers who work in the Abu Dhabi region to feel obligated to participate in my study. This familiarity allowed them the comfort needed to speak freely within their questionnaire responses. Most teachers at both PTMS and DSMS in the Abu Dhabi region have taught for more than 5 years and are largely from schools on the outskirts of the UAE with 1:1 technological access in their classrooms. A letter of permission was requested from the

building administrator to allow me to collect data at both PTMS and DSMS in the Abu Dhabi region.

Each principal at the participating schools was sent a recruitment email from me and asked to forward it to all the teachers in their building. The teachers who decided to participate in the study were provided with an electronic letter of consent that explained the research and that their answers and identity would remain confidential. Additionally, the letter explained that the participants would not receive any compensation besides the possible benefit of improving technology PD at their school. Providing this information to my participants at the outset of their participation provided transparency to the qualitative research design (see Creswell & Poth, 2018).

Establishing a Working Relationship with Participants

Prior to this study, I worked as an academic vice principal for one of the middle schools. This allowed me to maintain a positive relationship with the current principal, which granted me access to the school. As the academic vice principal of one school, I was able to get to know the current principal of the second school, who is also a professional colleague and was eager to support my research. My colleague and I collaborated often during the pandemic to problem solve and support one another. As a result, I invited their school to be part of the study. Since the start of my research project, I have moved and changed positions. Because of this, participants did not feel any pressure or obligation to participate. My new role also allows me to be more objective about the data because I am not the participants' direct supervisor. During my time in the

district, I had a positive working relationship with those in my school and with the administration of the second school as well.

Measures to Protect the Rights of Participants

Participants' confidentiality was protected by not collecting names on the questionnaires. All the participants signed an informed consent form prior to participating in the study, which indicated that they may experience uncomfortable feelings when asked to share their experiences teaching remotely during the pandemic. The consent form also explained that the participants could stop participating at any time without any concern of negative consequences. Additionally, including a second middle school better protected participants' identities because more teachers were invited to participate whom I do not know professionally. The consent forms were the only documentation that collected names. To maintain confidentiality, study participants were assigned alphanumeric codes. The interview participants were assigned PA and PB for the two interviews because data saturation was reached after the second one. Those participants who responded to the questionnaire were designated as QP1 through QP32, although questionnaire data saturation was reached at QP 25.

Data Collection

Data collection began after IRB approval was received. The entire data collection period spanned 4 weeks. The first week, a recruitment email was sent to the principals of both schools to invite faculty to participate. During the second week, I sent a reminder email to both schools to encourage teachers to participate in the study. I also began to schedule the interviews this week. Weeks three and four were spent conducting the

interviews and sending a final reminder to the teachers for one last chance to participate in the study if they had not done so already. The instruments for data collection will be described in this section along with an explanation of the data analysis, the limitations, and the credibility.

Instrumentation

The online questionnaire (see Appendix C) and the interview question protocol (see Appendix D) both contained 12 open-ended questions that allowed participants to share their thoughts, feelings, experiences, and perceptions without being limited to provided choices. The interview questions were aligned with the research questions (see Appendix E). The two instruments did not have identical questions so unique nuances could be generated from both groups to add to the rich complexity of the data by allowing each method to be analyzed separately (see Harris & Brown, 2010). The questions followed a qualitative research design that "focus[ed] on participants' multiple perspectives and meanings" (see Creswell & Poth, 2018, p. 83), an additional measure of qualitative research design. This also allowed my data sets to be viewed through nuanced lenses relating back to human behavior that quantitative design restricts. According to Creswell and Poth (2018), participants should feel that their opinion matters and be allowed to freely share their stories and experiences without judgment relating to the use of game-based technology assessment tools.

Procedures

The data collection process began by sending a recruitment email that included an explanation of the study at the beginning of the first week. The email provided two

options to participate in the study: completing an online questionnaire or scheduling an interview with the researcher. At the bottom of the email was a link that connected the participant to either the online questionnaire or a form to sign up for an interview. Those who chose to complete the questionnaire had to first read the letter of consent and then provide an electronic signature prior to accessing the questions. The participants who preferred an interview were contacted to schedule a time to meet using Zoom. Interview participants read and electronically signed an informed consent form before the interview began.

During the second week, I scheduled and conducted the virtual interviews, which were recorded for transcription. The participants shared their email addresses with me by filling out a simple form for interview participants linked to the recruitment email. Before the virtual interviews took place, I emailed each participant a consent form asking them to complete it. Prior to each interview, I made sure I had the participant's signed consent form. Verbal consent was given immediately before the interview began so that participants were fully aware of the study and their rights.

During the interviews, I asked questions about firsthand experiences, deeper explanations of experiences, and perceptions of game-based technology assessment tools (see Appendix D). Each interview was conducted on Zoom and began by completing an electronic informed consent. After each interview, the conversation was transcribed for coding. The interviews lasted approximately 40–45 minutes each.

Throughout the data collection process, all the participants' identities remained confidential. Their names were only collected on the informed consent forms. Each

participant was assigned an alphanumeric code to maintain confidentiality. All the data were encrypted and saved on a password-protected computer on an external drive.

Analysis of the Data

Data from the questionnaires were gathered from an electronic form and downloaded into spreadsheets for coding analysis. Interviews were conducted using a video conferencing tool that allowed me to record the sessions. After the interview sessions, I used the Zoom audio transcription tool that transcribed the interview to allow for coding. Then, I organized the data into spreadsheets to prepare for coding and reading. I read through all the data several times to become familiar with the information and to get a sense of it before I began coding. Using the constant comparative method of data analysis (see Glaser & Strauss, 1967), I read each questionnaire answer and the transcripts to identify units of data, or thematic codes, that answered the research questions. Data saturation occurs when no new data or observations from the interview participants were obtained (Lincoln & Guba, 1985, as cited in Merriam & Tisdell, 2016). For the interviews, data saturation occurred at the second interview, participant PB, and data saturation for the questionnaires occurred at 25 QPs.

Coding Strategies

Once the data was collected, transcribed, and organized, I used a qualitative constant comparative method to identify similar themes and trends. I used an open coding method to break down, analyze, and categorize the codes into themes and trends (see Merriam & Tisdell, 2016). Using a spreadsheet, each of the participant's responses was categorized on its own sheet. This allowed me to analyze each one to identify repetitive

words, phrases, or comments and assign codes to them. The codes of the participants' responses from each data collection method on its own spreadsheet were compared to one another so that themes and trends were identified, which followed the constant comparative method.

Evidence of Quality and Procedures to Assure Accuracy and Credibility

To ensure the accuracy of the data, member checks were conducted by the participants to ensure that their responses were recorded correctly and aligned with their experiences so that each participant was represented correctly. This allowed the participants to have the opportunity to add to, edit, or verify their data. Additionally, conducting interviews is considered a credible form for collecting data because it allowed for the researcher to ask clarifying questions and the participants to clarify their responses. Saldaña (2021) stated: "strategies, in-depth interviewing that explores with participants the subtle dynamics of attributions in action" (p. 255) to avoid assuming the participant's meaning. Another form of transparency which adds credibility to my study is by including my coding maps (see Appendix F). Providing the data to the reader shows transparency and that the researcher attempted to remove bias.

Procedures for Dealing with Discrepant Cases

To ensure reliability and validity, any discrepant cases that did not align with other data were included in the results to show transparency, including any opposing viewpoints that a participant may have had regarding their acceptance of technology. As stated by Bashir et al. (2008), a strategy to increase the validity in qualitative researcher can "report negative or discrepant data that are an exception to patterns of that modify

patterns found in the data" (p. 43). While there are several methods of qualitative research, regardless of the approach, it is the researcher's responsibility to be transparent about the data and the connections that are made to answer the research questions.

Limitations in Data Collection

The limitations of this study derived primarily from two factors. First, an online questionnaire was certainly not the ideal data collection method of qualitative research design nor a basic study design. The data obtained from this questionnaire would have most certainly been enriched by face-to-face interviews with participants, as suggested by Creswell and Poth (2018). However, given the context of the COVID-19 pandemic and associated health and travel risks, all questionnaires and interviews were conducted using email, digital questionnaires, and video conferencing tools. In-person data collection would have provided a more authentic, personal connection between the research and the participant. Unfortunately, in-person meetings were not possible under the pandemic circumstances that prevented travel and required social distancing.

Data Analysis Results

After organizing the data according to the qualitative constant comparative method with open coding and axial strategy (Merriam & Tisdell, 2016), I was able to identify emergent themes in my data. Although the constant comparative method is commonly used for developing a grounded theory, "the constant comparative method of data analysis is inductive and comparative and so has been widely used throughout qualitative research to generate findings" (Merriam & Tisdell, 2016, p. 202). Following this process of open and axial coding, I then re-examined the data for the purpose of

selective coding, where codes were compared with codes to create themes (Corbin & Strauss, 2008; Saldaña, 2021). The above listed coding process is expressed at the end of this study (see Appendix F).

Theme 1: Positive Perceptions for Digital Learning Tools

Participants, both interviewed and those who completed the questionnaire were asked about their ease of comfort when it came to utilizing game-based technology as a tool for assessment. The questions examined their preference between hands-on learning and digital-learning practices. The questions emphasized teacher perceptions of game-based tools and were found to hold a fond preference to teachers. PA and PB expressed an overall satisfaction with digital learning tools. Participant A stated, “A wonderful and useful way in the educational process, which makes education fun and attractive to students.” As well, PB stated, “These are the best tools, which allow learners to have fun while learning.” Each of the QPs concurred with the interview participants when using the best educational tools to engage their students and the value of making learning fun. Later inspection proved a positive theme of personal preference may be derived from collective choices, whereby teachers acknowledged digital learning integration’s attractiveness and education relevance within their classrooms.

Theme 2: High Use of Digital Tools for Assessment

Upon further examination of the participant teachers’ perceptions at PTMS and DSMS, another theme is revealed. The teachers’ feedback revealed a prominent use of technology for assessment purposes in their classrooms. This was related post-examination to their answers on the resourcefulness and the impact game-based

technology assessment tools have on face-to-face and remote learning. Some teachers from both the interview and questionnaires also noted that it was not only preferential due to student bias, but because it also offers teachers digital assessments, charts, and graphs of student aptitudes, especially towards the learning targets during teaching assessment checkpoint. QP14 stated, “We use them as feedback for block assessment and future planning. It aids with assessing gaps in learning, along with how to improve upon our own teaching.” Whilst PA stated, “Kahoot can been used as a formative assessment since it informs me of the score of each individual student. I use this as an aid for the assessment for learning, in order to determine whether I have achieved my learning objectives. Also, it is an enjoyable tool to use for reviewing each students’ score, during my lessons and before formal examinations.” Each of the QPs indicated that they used these tools frequently, especially during remote teaching during the pandemic. QP12 stated: “By displaying the content of the lesson and asking probing questions, such as multiple choice and open-ended questions, allowed for a better method of delivery and a more in-depth interaction with the students.”

As stated by both the interview and questionnaire participants, the findings from teachers about their perceptions of the effectiveness of game-based learning technologies, proved to hold steady differently depending on departments and subject matter. Some teachers from both the interviews and questionnaires mentioned how game-based assessments have been used among certain departments. Teachers used technology frequently to model their lessons more effectively and to add variety to their lesson delivery. Additionally, QP3 indicated their preference for using technology because of

the valuable data that the tools provide teachers. QP17 responded: “By using the tools to create more interactive assessments, I am better able to provide personalized instruction in according to the data from the game-based assessments.” Another reason that was noted from the questionnaire participants (QP11, QP18, and QP22) is that they prefer using the game-based technology tools because it saves them time, provides better collaboration activities, and supports collaboration among students. Finally, another reason for the high use of these tools is that students learn through play and that students had a choice in how they wanted to learn to meet the learning objectives.

Theme 3: Game-Based Technology Assessment Tools Were Easy to Integrate

Another interesting niche observed from teachers’ responses in the questionnaire and from the interviews was that the learning acquisition process for adopting Kahoot, Alef, and Quizlet was simple. PA stated, “Many teachers at my school utilize game-based technology assessment tools to keep students actively engaged. I think it is important to help students stay motivated, for them to pace and monitor their own progress.” Based on this response, teachers clearly noted their competency towards game-based learning tools relied on their individual observation or the competency of other teachers’ familiarity and aid. With that being said, interview PB stated, “I could say that some of the teachers in each department used it effectively, while other teachers in other departments didn’t use any game-based technology assessment tools in their classes.”

Participants who completed the questionnaire showed similar responses. QP8 commented that they: “loved using the game-based technology tools for easy interactive activities during the discovery stage of the lesson and for quick and simple student self-

evaluation in exit tickets." QP25 wrote that "in my classroom, I use Kahoot because not only do the students enjoy it, but it is really easy for them to form groups and work together and compete between other teams." As such, this is an important theme to know as knowledge acquisition complexity might be the reasoning behind the fundamental success of such tools. In other words, the fact the tool is easy to learn, enjoyable for students, and compiles data in an accessible and efficient manner lends to the appeal it has within academic classrooms.

Theme 4: Barriers for Using Game-Based Technology Assessment Tools

A growing concern and recurring theme between the two middle schools were the teachers' aptitude towards understanding and assessing the information through the game-based tools. Even though teachers reported that these digital tools were simple to use, they had a few concerns with the implementation of these digital tools at their schools. PA stated, "We need an approval from management to bring our own devices, in addition to more funding for any technology-related fees, such as a strong network connection. Also, we would need time for trial-and-error periods with our students." Additionally, PA commented that it would be beneficial if management could embrace technology-based learning and not be hesitant to incorporate new programs. This was a point of concern because it would have caused a level of inconsistency in the school or nearly created a drought in potential data collection. Also, data and graphs might not be easy to read for all teachers of any subject matter as it requires some degree or understanding of graphs to be able to understand directly.

Some participants were concerned about the overdependency of the game-based technology tools. QP24 commented that the: “Overuse of the game-based tools will cause the students to be bored.” Essentially, the novelty wears off and the game-based tools should be just one of the many tools and strategies in teachers’ instruction and assessment to maintain variety in teaching and learning. Another barrier to overdependency that was evidenced in the questionnaire by QPs 1, 7, 12, 15, and 24, was that when all of the teachers were online at the same time, the school’s internet could not support all of the devices. As a result, the internet would crash and there were not enough IT personnel to support the entire school.

Theme 5: The Need for Customized Professional Development

To support this theme, PB stated, “I would recommend PD sessions about the different points of view of the educator and student on these digital tools. As a result, teachers would gain a stronger understanding of how both points of view might appear. While using these digital tools, I think there should be a follow-up session, immediately after a PD session is given, in order to allow room for reflection.” To ensure that these PD sessions are productive, PA stated, “PD timings and sessions must be well thought out. Preferably, they should not take place after a long day of teaching, as the teacher might feel exhausted.

Questionnaire participants (QP3, QP8, QP13, QP14, QP25) indicated that they wanted more hands-on, face-to-face technology PD. Several QPs commented that they would benefit from demonstrations of the tool instead of having to learn how to use new technology on their own. QP13 stated that they: “want more practical PD sessions where

the teacher can experience the tool from the student perspective." QP14 also stated that: "I prefer to be able to pick and choose from various modalities or learning styles. I would benefit more from learning more advanced uses of the tools in a professional development session." On the other hand, the knowledge of such tools should be endowed on the teachers by all administration staff, as cautioned and remarked by almost all the teacher study participants.

Section 3: The Project

Introduction

The findings of this study served as the basis for the development of a PD project. The goal of the PD training course (see Appendix A) was to increase teachers' comfort level and efficacy with technological tools—specifically, game-based technology assessment tools applications. Teachers collaborating on an online learning space will be introduced to PTMS and DSMS, as well as other targeted schools in the UAE, upon final approval of this study from Walden University.

Project Design

The project was created using an online space where teachers can access lessons about each of the three game-based technology assessment tools (Alef, Kahoot, and Quizlet) and collaborative learning spaces through open discussion boards and the assignment of a critical friend group to experience the learning process together. This PD training course will be an online, self-paced course that will be in the school's LMS so it can be accessible to all faculty.

Module #1: Alef (Week 1-4)

Learning Target: Learners will be able to utilize Alef as a formative assessment tool to monitor student progress with previously taught learning objectives.

Activities:

1. Video: "Alef Education's Digital Learning Platforms"
2. Video: "Alef Platform"

Materials/Equipment: Google Classroom, YouTube, personal electronic devices for teachers (phones, tablets, or laptops).

Evaluation: teacher experience and growth evaluated through their contributions to the group discussion board and from the module through Google Form exit questionnaire.

Each learning module focuses on a specific game-based technology assessment tool and will highlight the ways in which these technologies will improve lesson efficiency and learning engagement, providing examples of how to use each technology to positively influence teachers' perceptions about the tools. Focusing on these three aspects, teachers will be given consequence-free trial-and-error activities to practice these technologies in their classrooms. After each time a teacher practices with a new form of the technology, the PD course has built in reflection opportunities that follow each implementation. This way other teachers who are also completing the PD training can collaborate on their implementation on discussion boards. Each module will contain three different tasks involving the application that teachers will attempt in their classrooms. The modules have been constructed using principles of transcendence (see Magana, 2017) in which teachers' tasks will be to achieve successful integration of the technology in their

classrooms by constructing or reconstructing lesson plans to incorporate the technology for different purposes. These tasks were included using the application in three ways:

(a) to activate the learner's schemata prior to introducing new learning objectives,

(b) to apply new concepts about specific technology tools to help learners reinforce new skills, and

(c) as a formative assessment to monitor learner progress with previously taught learning objectives.

Rationale

The three self-directed learning modules were developed according to Magana's (2017) T3 framework for innovation used for this study. This framework is divided into three levels: (a) T1, translational, in which technology is used for the automation of digital tasks and consumption of digital content; (b) T2, transformational, in which technology is used for the production of understandings and contribution to the learning of others; and (c) T3, transcendent, technology is used for inquiry design to provide solutions and the social entrepreneurship of providing results to problems. The T3 learning framework supports teachers in their incremental technology growth and development by helping them to experience an authentic understanding of the benefits of the specific technologies they are learning to use while being given specific processes of feedback from their peers and self-assessment within their usage. The goal of this project is for faculty to achieve technology transcendence (see Magana, 2017) through their use of game-based technology assessment tools. This goal has been selected based on the results of the data in which teachers widely stated that if they could understand the

benefits of the technology, they would be more inclined to accept the challenge of learning its usage.

Peer-to-peer learning via the critical friend group format was selected for this PD to satisfy the needs of a supportive learning space identified in the questionnaire data (see Appendix G). Collaborative, flexible, and reflexive spaces are a key driving force within the T3 transcendence model. These spaces have been incorporated in the project through discussion boards and reflective questionnaires.

Overall, the study data indicated in Theme 4 the barriers for using game-based technology tools was that teachers prefer a low-risk, self-paced training that provides peer-to-peer support over having to attend traditional, face-to-face trainings where little opportunity to practice with technology is provided. The teachers also indicated the importance of peer feedback and reflection after testing a technology tool. This three-module PD training program organized in levels according to the T3 framework will provide teachers with the opportunity to review, learn, practice, and apply game-based technology assessment tools to their lessons, achieving transcendence.

Review of the Literature

In Section 1, my literature review consisted of the following themes derived from my data analysis: TAM, teachers' perceptions of technology, technology PD, student engagement, and technology and game-based technology assessment tools in education. Based on the data from Section 1 and the type of project I sought to create the topics for this literature review are the T3 framework (Magana, 2017), effective strategies in teacher PD teacher-led and peer-to-peer PD strategies, faculty learning communities, and

the critical friend group model of teacher support. Of these topics, my initial review of existing literature started with a focus on the T3 model as it would be used as the framework for my PD training project. In brief, this framework is designed to improve instructional practice with the use of technology. The T3 framework includes three levels that challenge teachers to design curriculum that uses technology for typical automation tasks at the first level, to use technology to demonstrate their understanding at the second level, and to challenge students at the third level to use technology to support inquiry and find answers to real-world problems. At the highest level, students are involved in projects in which they are designing and attempting to solve problems that matter to them and their community.

Making use of Walden University's online library of peer-reviewed articles as well as scholarly search engines, I started by searching for articles about T3 in a broad sense. As T3 is a relatively new framework, this did not bring about many results. I then narrowed my search to literature written by Magana (2017). By combining Magana's research and theories with my key search terms *professional development*, *teacher-led faculty learning*, *teacher support networks*, and the topics mentioned in the T3 framework (*effective strategies in teacher PD*, *teacher-led* and *peer-to-peer PD strategies, faculty learning communities*, and the *critical friend group model of teacher support*), I was able to find ways in which the T3 model could assist me in planning a full PD curriculum for improving teachers' knowledge and experiences with game-based technology assessment tools in the classroom. In some circumstances, I have chosen to include sources older than 5 years as there does exist a slight gap in current research. This

allowed me to have a well-balanced look at the evolution of PD strategies in combination with the T3 framework. The following literature review will begin with a summary of Magana's (2017) T3 framework followed by its influence on my PD programming through an examination of the literature on the peripheral topics listed.

T3 Framework

I used the T3 framework as the lens through which to plan my PD program. Magana (2017) established this model to "contextualize our thinking about digital innovation in education within a clear framework that is useful and actionable" (p. 13). This framework was designed as a framework for designing a curriculum that uses technology where students are the learners. However, in a PD capacity, the teachers will be the learners engaging in activities that fall within Magana's paradigm.

Juxtaposing Magana's (2017) T3 framework with that of TPACK (Mishra & Koehler, 2006) and substitution, augmentation, modification, and redefinition (SAMR) (Puentedura, 2015) expose the weaknesses of the latter two. Within the TPACK framework, Magana argued that while the technical knowledge of teachers is certainly paramount, the existing framework does not provide scaffolding to ensure teachers are able to increase their knowledge. Magana (2017) claimed this model "lacks a thorough elucidation of the steps one might reasonably follow to develop technological knowledge" (p. 17). According to Magana, the biggest weakness of the TPACK framework is the ambiguity of goals pushed onto teachers. Magana asked, rhetorically, how teachers are to measure their technological knowledge gaps and set reasonable goals

while this framework clearly lacks the specificity to lend a definition to technological knowledge as a whole.

Similarly, Magana (2017) addressed the weakness of the SAMR model. Within this model, the final stage of redefinition sees the creation of new opportunities made possible by technology (Puentedura, 2006). This allows the SAMR model to have a wide application, extending outside educational contexts; however, it provides an abstract framework for any real applicability to the educational world because it lacks a defined context for using technology in specific educational circumstances, which leads to a "misapplication of the model in the realm of teaching and learning" (Magana, 2017, p. 19). Thus, Magana conceived a new conceptual framework, the T3 model, an innovative look at technology integration frameworks in education centered around three-tiered steps: (a) translational technology use, (b) transformational technology use, and (c) transcendent technology use.

The first tier of translational technology use centers around the idea that tasks once completed manually may now be completed using technology. From my perspective and that of the data from my research, this stage has mostly been tackled by administrations where teachers are making use of basic technology by having students' complete assignments using word processing software and reading lessons on PowerPoint presentations made by the teachers. Another example is when teachers or students are using the electronic whiteboard or a whiteboard app for writing and note taking.

The second tier of Magana's (2017) T3 framework focuses on "substantive disruptions or changes" (p. 21) to existing tasks or roles where new educational processes

and tasks are born from technology, not simply the innovation of existing paradigms. Here, technology has the most power in education (Magana, 2017). In relation to my research into game-based technology assessment tools and their ease of use by teachers, this tier is exceptionally useful as many of these technologies incorporate completely new assessment styles into the classroom—not simply an innovation of existing strategies. Students are challenged to use critical thinking skills and even collaboration skills during formative assessment activities.

Finally, the third tier of technological transcendence lends its strength to my research and subsequent development of a PD program by outlining the steps by which both educators and learners can embrace technology to reach "previously unobtainable heights" (Magana, 2017, p. 21). The implementation of game-based assessment and learning tools in the classroom provides outcomes that have previously been unreachable—namely, that of instant learning feedback for students at a diminished output for teachers. To train teachers to use these new technological tools, they need to understand Magana's (2017) concept of transcendence not only to envision the possible revolutionary benefits to their learners. As shown in Appendix F, teachers can fully understand the benefits of technology and are more inclined to accept the challenge of learning its usage. In my PD curriculum, teachers must use elements of transcendence while on their journey to using more game-based technological tools in their classrooms.

Magana (2017) stated that while schools have invested in massive amounts of classroom technology, they have remained in the first tier of his framework, translational technology use. To remedy this, teachers need to understand the value-adding properties

of technology and be given specific processes of feedback and self-assessment within technology usage (Magana, 2017). My PD program seeks to include these processes to help schools reach the second and third tiers of the T3 framework. As such, much of my focus surrounding Magana's research has rested on explanations of the third tier: technology transcendence.

Technology Transcendence

While Magana's (2017) description of the transcendence tier focuses on student learning and engagement, I have decided to make use of teachers as students for my game-based technology assessment tool online PD training, which seeks to engage teachers in productive PD surrounding technology. His explanations of this tier center around student passion for the possibilities provided by technology. In my PD program, teachers will be the students.

As such, when he stated that it is "of critical importance that students are given the opportunity to investigate problems that matter to them, design questions that address those problems and then use the tools of research and inquiry to generate solutions to those problems," (Magana, 2017, p. 68), this is equally important for educators as well. Unless teachers are taught how to use technology at more challenging levels, they will continue to utilize it for basic tasks. As such, my PD program must provide teachers with opportunities to take ownership of learning the new technology and invest in its value-added properties to be most effective. In fact, his "initial inquiry design steps" (Magana, 2017, p. 70) outlined a key process that I will adopt in my teacher PD program.

First, Magana (2017) stated to give students—hereto referred to as *teachers* for the purposes of my programming—an opportunity to brainstorm issues and problems within their daily educational experiences together, as a collective. Next, Magana submitted that the collective should identify the problem to be considered the highest priority. Again, in my context, this issue is likely to be things outlined by teachers in each of their interviews such as assessment feedback, innovative learning objectives, and student engagement. Magana continued by stating that the group should "craft a group problem statement" where the problem is clearly defined alongside the "attributes of desired outcomes" p. 70). As I intend to run a teacher-led or peer-to-peer learning community-style PD program, this inquiry design model of generating passion for technology is of exceptional value to my project (Magana 2017).

Magana (2017) outlined the next step of a questionnaire of existing knowledge in combination with a collective of sources that may help the collective solve their highlighted problem. However, for the purposes of my PD plan, the solutions will be provided in the form of learning technology studied, namely: Quizlet, Kahoot, and Alef. Teachers will be challenged, as Magana stated, to critically analyze the problem by examining the features and intricacies of each technological learning platform. While it may seem contrived and calculated to ask teachers to produce the problem statement and then present the solution as the above technology, the problem statement most likely to be created will be surrounding the learning and implementation of these technologies themselves.

T3 aligns clearly with principles laid out by the International Society for Technology in Education (ISTE), an international organization made up of educators around the world with a mission and vision focused on empowering educators to both realize and utilize the power of technology in their lessons ("Explore the ISTE Educator Standards," 2018). ISTE specifically outlines standards for educators that champion ideas like extensive peer collaboration between teachers, dedicated planning time, designing authentic learning tasks, and analyzing new ways of completing old tasks in the classroom. These standards provide a succinct match-up to many principles of T3, such as the requirements of collaborative reflection, transformation of old tasks, and the recognition and acceptance of the power of technology in the classroom to enhance learning.

Effective Teacher Professional Development

Following my in-depth reading of Magana (2017), I decided to investigate existing research surrounding effective teacher PD. To be able to create a gamified-learning tools-centered PD curriculum that hinges upon Magana's (2017) principles but is still grounded in effective PD, I focused on effective PD that is teacher-led. However, I initially wanted to perform a brief questionnaire of the literature surrounding technology-focused PD to confirm my desire to plan collaborative learning groups as Magana's (2017) T3 model suggests.

First, I consulted Ratnayake et al. (2020). Here, the literature suggested that the most important aspect of improving the use of technology in classrooms is creating opportunities for increased "teacher involvement in task development" (Ratnayake et al.,

2020, p. 1,423). They further state that the most effective PD should not be exclusively focused on content but rather should focus in-depth on providing opportunities for learning that is personalized, active, and collaborative (Ratnayake, et al., 2020).

While not distinctly discussing this in relation to learning groups, Ratnayake et al. (2020) still supported the technology transcendence framework which implies that teachers should be intimately involved in the entire process of implementing technology into their classrooms (Magana, 2017). Ratnayake et al. (2020) found that many teachers preferred to use pre-made digital technology tasks in lieu of creating their own. Teachers also self-reported that working with other teachers 'tech-experts' enhanced both their understanding of the technology and execution of lessons including the technology.

Overall, the most useful piece of information from Ratnayake's (2020) study was about PD for digital technology task design by secondary mathematics teachers. This confirms that no matter if teacher learning is individual or collective, technology-based PD is most effective when "learning activities that involve participants in acquiring, using and evaluating new knowledge, and allow sufficient time for topic complexity, group discussion, active learning tasks, examples with direct application to participants' work setting, and follow-up support." (Ratnayake et. al., 2020, p. 1,423).

Similarly, Muriel et al. (2017) affirm that teachers must be provided avenues of support in tackling the ever-changing landscape that is technology usage in classrooms. Of particular interest to my research was the submission that teachers must, "adopt a designer's mindset [where] they see themselves as designers of learning experiences" (Muriel et al., 2017, p. 1). This links to principles of learning groups put forward by

Magana (2017) where teachers are in the driver's seat of identifying issues and collectively working towards solutions. Here, the teachers are taking on a designer mindset. The teachers submit that the concepts behind the maker movement should be incorporated into teacher technology PD where teachers are a part of communities in which ideas are shared and participants are tasked with projects. Magana's model of transcendence includes exactly that, with a slight variation of supportive learning groups that are not tasked with projects but that create them with the goal of solving a common problem.

Following this general questionnaire of existing thought surrounding technology-focused best practice in PD, I widened my scope to different models of effective PD as a whole to gather ideas and formats from which I might format my PD curricula with the goal of achieving technology transcendence (Magana, 2017).

First, I consulted Yurteven et al. (2020), who suggested that the most effective methodology of PD is that of a flipped PD model, "a form of blended models [combining] online videos with face-to-face meetings" (p.161). They stated that effective PD sessions are ones where teacher participation is high, and it is the "additional scheduling and programming flexibilities" (Yurteven et al., 2020, p.161) of the flipped model that helps to make the arduous task of making long term PD curricula sustainable for teachers. Moreover, they claim that supplementing traditional face-to-face PD learning opportunities with asynchronous tasks also "encourages the contributions of teachers who tend to be silent in face-to-face situations" (Yurteven et al., 2020, p.161). Therefore, I can presume that incorporating some flexible, asynchronous learning

opportunities into my month-long PD curriculum will be exceptionally beneficial for its success and learning outcomes.

In addition to this, Yurteven et al. (2020) stated that their research showed that "directly connecting PD activities to teachers' content area can lead to more student-centered use of technology" (Yurteven et al., 2020, p. 162). It will be important for me, then, to consider the subject areas of teachers participating in my month-long PD sessions while planning their content and implementation. Further, Yurteven et al. submitted that as teachers are adults, they will respond more to PD sessions that are task-oriented and have "concrete applications of what they are learning and to connect current learning activities to prior learning and professional experiences" (Yurteven et al., 2020, p.162). Overall, the outcome of this body of research is that for PD sessions to be successful, they need to be interactive and make room for both collaborative interactions with peers and ample reflection. These ideas blend perfectly with that of Magana (2017) and his concept of technology transcendence training where learners actively work together to solve collective issues.

Lambirth et al. (2019) focused on the results of a study of more than 150 educators in K-12 education in the United Kingdom about the value of teacher-led PD. They agreed with the research of Yurteven et al. (2020) and stated that effective PD sessions center around teacher "collaboration and expert challenge" with a heavy focus on "teachers' ability to seek to understand how and why practices work and how to implement them successfully in different contexts" (Lambirth et al., 2019, p. 815). Certainly, this sentiment compliments the notion of reflective practices stated by

Yurteven et al. More important for the purposes of my research is how this notion further complements the concepts of collaboration included in Magana's (2017) technology transcendence phase.

Teacher-Led Professional Development

Similar still is the research of Macias (2017) focused on teacher-led PD where it was found that the most effective PD sessions "boast classroom teachers as trainers" (p. 77). However, they found that there remain significant roadblocks to using teachers in training and coaching roles. They stated that many teachers questioned in their research indicated the limitations of a top-down structured PD curriculum where there is a significant "lack of option or input from participants' (Macias, 2017, p. 77). As such, Macias used their research to argue for completely teacher-led PD sessions where "classroom teachers are making decisions, selecting topics, and designing workshops outside of the pressures of employers' goals" (p. 77). This synchronizes nicely with the concept of technological transcendence where Magana (2017) argues that learners themselves must collectively identify and work to solve technologically focused issues.

Macias (2017) outlined the sheer ineffectiveness of top-down focused PD structures and advocated for bottom-up restructuring. They stated that in bottom-up frameworks, "the focus is more on the teachers' empowerment and learning" (Macias, 2017, p. 78) rendering it far more in line with Magana's (2017) principles than any PD strategies where the teachers themselves are not the main stakeholders. Parroting the research of Yurteven et al. (2020), this study championed teacher-led PD that hinges upon "choice, flexibility, incremental steps, and supportive accountability" (p. 80). Most

importantly, this research introduced the acquisition of professional capital for teachers as being a key tenet of effective PD as it encourages investment from teachers as learners. The teachers outlined that effective teacher-led PD must include social processes, opportunities to collaborate, lend stability, assume teachers as active learners, bring about deepened pedagogical skills, provide time for reflection, and, finally, focus on how students will benefit.

Swai and Glanfield (2018) centered their research around mathematic teachers and their experiences during teacher-led PD sessions. In their preliminary research and questionnaires, they found that teachers reported feeling as though PD leaders, who were not themselves teachers, "lacked a broader understanding of the realities of teaching in classrooms" (Swai & Glanfield, 2018, p. 184). Instead, they attested that teacher-led training sessions, where the teacher as facilitator is acutely aware of the trials of modern-day classrooms are a much more sustainable approach to PD. This sentiment was certainly echoed in my qualitative research where participants stated that they felt their administrators do not fully understand, or are unable to conceive, of ways in which technology can be integrated into the classroom.

Swai and Glanfield (2018) questioned teachers who participated in teacher-led training sessions and found many reporting sentiments of feeling as though their trainer was 'one of them' which allowed them to speak more freely and interact with the learning objective more authentically. This lends support to Magana's (2017) argument that learners need a stake in the game to be truly reflective participants. Most notably, Swai and Glanfield found that teacher-led PD sessions led to "a sense of confidence and

comfort in participating in the professional activities" (p. 187). From this, I have learned that providing safe and authentic avenues for teachers to share and reflect on their existing practices is an integral part of a planning PD curriculum, specifically in the technology sphere as prior knowledge among participants can be, as shown by my qualitative study, quite varied. Overall, it is Swai and Glanfield's findings that teacher-led PD sessions "produce a friendly and collegial learning environment [which] encourages long-term collaboration among teachers and teacher leaders" (p.189) that is most significant to my PD curriculum planning.

Tang et al. (2018) focused their research on information communication technology (ICT) teachers' experiences with bottom-up PD training. This study was most significant to my research for its direct comparison of teachers' experiences in both top-down and bottom-up PD settings. While they found that the bottom-up method required more effort and input from the trainer themselves, in this instance an ICT teacher (Tang, 2018, p. 155), learners from the top-down group learned "robot-like operations they couldn't apply to the real situations of their learnings" (Tang, et. al., 2018, p. 154). This supports the research of both Lambirth et al. (2019) and Swai and Glanfield (2018) which conclude that bottom-up learning for teachers in PD supports more authentic learning.

The research of Balta and Eryilmaz (2019) on the impact teacher-led PD has on student learning, was an important consideration on the effectiveness of PD outside of teachers' thoughts and feelings. They list the criteria for effective teacher-led PD in a similar fashion to all previously mentioned research, that teachers need to be given the

opportunity to “observe, reflect, exchange ideas, and share problem-solving” (Balta & Eryilmaz, 2019, p. 591).

Balta and Eryilmaz (2019) examined six high schools in Turkey after a 7-week teacher-led PD sessions of 20 hours and found student achievement significantly affected. Put blankly, they stated, “if a teacher fails to carry new knowledge from PD to classroom practice, students will not benefit from the teacher’s PD” (Balta & Eryilmaz, 2019, p. 591). This statement links to both the findings of Tang et al. (2018) and Swai and Glanfield (2018) who found that external or administrator-led PD sessions give teachers knowledge that ranges from difficult to impossible to use in the classroom.

Of use to me in this study was the methodology they prescribed for teacher leaders. They stated that the most effective implementation of teacher-led PD sessions occurs when the teacher is given more than a week to prepare their course and an atmosphere of support and inquiry among participating teachers is maintained (Balta & Eryilmaz, 2019). From this, I have learned to prioritize teachers as facilitators in planning my PD curriculum.

Peer-to-Peer Professional Learning

The natural progression of my literature review led me then from teacher-led PD to peer-to-peer professional learning. Following Magana (2017)’s model of how to achieve technology transcendence, learners are placed in groups and work collectively to propel their knowledge forward. I began by searching known academic databases for peer-to-peer learning in the teaching sphere. This appeared to be an extremely limited

search of research with extremely minimal research available on the effectiveness of peer-to-peer teacher learning in a PD context.

As such, I began by consulting Shawa and Botma (2020). In their research, Shawa and Botma investigated peer support between teachers during a time of curriculum upheaval. Their research outlines ways in which peer support amongst teachers can be enhanced and fostered, which is especially useful for the development of my teacher-centric PD curriculum. First, they found that for peer support to occur among educators, those chosen as support leaders should possess "experience, motivation, and commitment to peer support" (Shawa & Botma, 2020, p. 188). In terms of peer support strategies, Shawa and Botma stated that support is most reported when learners are subjected to "group support approaches and paired techniques" (p. 188). They further suggested that any material disseminated should be tailor-made to learners and any form of assessment of learning should be done exclusively in collaboration (Shawa & Botma, 2020). Despite these guidelines being developed for nursing educators during a time of curriculum upheaval, they still suit my research about trying to develop peer-to-peer support among teachers.

The next source I was able to locate that seemed relevant to PD systems hinged upon collaborative, peer-to-peer learning outcomes was Spies et al. (2021). Similar to Shawa and Botma (2020) in that it looked at peer-teaching in a medical context, Spies et al. examined learning strategies that aided medical students in their formal examinations. They introduced the term near-peer teaching which I found applicable to my research. Near-peer teaching is "a type of peer teaching in which students who are one or more

years senior in the same program as the more junior students and have previously completed the same coursework or activities, teach some portion of the course" (Spies et al., 2021, p. 82). While not completely relevant to my planning of a PD curriculum, it does serve to reinforce the statements made by Magana (2017) that group work led by a peer is the most effective learning environment to achieve technology transcendence.

Faculty Learning Communities

Due to the lack of research surrounding peer-to-peer teaching and learning in educational PD contexts, I then shifted my research toward literature surrounding faculty learning communities. While not specifically tailored to PD sessions and curriculum planning, faculty learning communities represent the type of learner interaction Magana (2017) strives to achieve in the technology transcendence pillar of his T3 Model. As such, I performed a general questionnaire of existing literature on this topic.

I started with Gomillion et al. (2020) who found that working in education can be isolating, where "each teacher is working alone on their material or independently in their classrooms" (p. 75). They suggest faculty learning communities can remedy this isolation and define it as a group of six to fifteen faculty from all disciplines who collaborate in a yearlong program guided by a curriculum that is designed to improve teaching and learning throughout the year. This collaborative faculty group would ideally participate in scholarships, workshops, seminars, and building a productive learning community within their building (Gomillion et al., 2020). Referring to Gomillion et al. the points on how to establish a new faculty learning community are regarded as one of the most important considerations when forming these groups in the modeling of community. Namely,

members should “have belonging, a feeling that members matter to one another and to the group, and a shared faith that the members’ needs will be met through their commitment to being together” (Gomillion et al., 2020, p. 77). This is significant to me as it will be a key pillar in the formation of my teacher learning groups, created in the image of Magana (2017). Gomillion et al. further stated that learning communities need not occur face-to-face but rather, be more focused on values like, “safety and trust, openness, respect, responsiveness, esprit de corps [a feeling of pride], and empowerment” (p. 77). This strengthens the flexibility of my PD curriculum planning as I feel released from the need for meetings to occur face-to-face.

In a similar vein, Dancy et al. (2017) discussed how transitioning in-person learning communities to online creates a new, more sustainable approach to teacher learning and development. They state that their faculty online learning community members were extremely welcoming places where members achieved growth “through a supportive community in which members trouble-shoot teaching challenges and learn from peers and experts” (Dancy et al., 2017, p. 1). It seems, then, that when organizing my PD training sessions, my priority should be on the learning environment and relationships instead of the medium of meetings.

Dich et al. (2017) took a different approach in their research by focusing exclusively on how faculty learning community failures can help teachers in examining their failures. By collectively examining these failures, they were pointed “to different considerations of [their] research design, context, and data” (Dich et al., 2017, p. 1). I found this to be a novel approach to discussing faculty learning communities and useful

for my research in the sense that it follows the principle of consistent reflection set out by Magana (2017). Dich et al. stated that it was the environment of trust developed within their faculty learning community (FLC) that allowed them to adequately reflect, build upon and correct their failures. In this sense, my research is validated that safe, caring, reflective collective spaces are crucial for effective learning processes for educators. They included notes that in many cases, it was their participation in supportive faculty learning communities that "encouraged [them] to approach [their] results from a different perspective" (Dich et al., 2017, p. 11).

A large barrier to teacher implementation of technology in their classrooms, as evidenced by several of my participant interviews, was an overall fear of failure during implementation and a lack of supportive connections to other teachers and administrations. Dich et al. (2017) confirmed to me that in my PD curriculum, I must be sure to create a supportive environment where discussions of "failures" are seen more as trial-and-error scenarios that should be shared and collectively reflected upon by a team of supportive members. In this way, I can achieve the atmosphere outlined by Magana (2017) and encourage growth and acceptance of these new technological methodologies, leading to technology transcendence.

Dancy et al. (2019) discussed the validity of faculty learning communities facilitated online as mechanisms for educational change. Certainly, with the overall goal for my PD curricula being technology transcendence, examining faculty learning communities held online with the goal of evoking change is of high interest to me in my planning stages. They stated that "teaching growth is accomplished through a supportive

community in which members trouble-shoot teaching challenges and learn from peers" (Dancy et al., 2019, p. 1) and suggested that while previous methods of teacher training may increase teacher knowledge and motivation to implement new methodologies, this alone is not enough to spark meaningful and lasting change. The biggest downfall, they said, is the lack of reflective thinking promoted in these previous training because the "emphasis is placed on the innovation itself, with little attention paid to the potential adopters and their affordances and barriers to change" (Dancy et al., 2019, p. 2). Adopting Magana's (2017) model of collective thought and reflection, surely, redirects this misstep. Dancy et al. (2019) instead, suggest that faculty learning communities - and especially those facilitated online - allow educators to "learn with and from each other, mutually engaging in activities and developing and sharing resources" (Dancy et al., 2019, p. 4). Surely, this further cements the concept of my own budding PD curricula as a reflective juncture through which teachers can develop confidence in new mechanisms.

Furthermore, Dancy et al. (2019) outlined the advantages of transitioning these faculty learning communities online, which suits my planning exceptionally. They stated that one of the major benefits of online facilitation is that "there is no need for participants to be geographically close" (Dancy et al., 2019, p. 4). This allows faculty learning communities to be extended across various institutions which, they submitted, eliminates the awkward position of members from one institution "having to evaluate one another, which allows them to be more open and vulnerable about difficulties they may be having" (Dancy et al., 2019, p. 4). This is an interesting take as I originally would not

have considered opening my learning groups to separate institutions. However, Dancy, et al. made a compelling case for increasing the authenticity of interactions.

Happel et al. (2020) provide useful research findings for the purposes of developing my own PD curriculum as well as their research hinged upon examining teacher opinions following their participation in a faculty learning community. Of particular interest to me were the experiences of participants in unstructured faculty learning communities as they are most related to the atmosphere described by Magana (2017). Happel et al. described unstructured faculty learning communities as having "highly flexible approaches with minimal to no support from the teaching center [where] faculty control all aspects of the experience, such as meeting times and frequency, group members, project goals and focus, distribution of group roles" (p. 53). While this does seem daunting to me from a planning perspective, it was useful to read the overwhelmingly positive reviews from educators who participated in this type of faculty learning community. It relates back to the original aspects of my planning I had hoped to incorporate, which are teacher-led sessions and peer-to-peer learning, just described using different classification terms.

Happel et al. (2020) came to extremely valuable conclusions in their research findings. For example, they found that "the presence of shared goals and structures (such as setting and agreeing on a goal, identifying and using individuals' strengths, assigned roles) were considered important facilitators of effective collaboration" (Happel, et al., 2020, p. 62). Happel et al. 's research further confirms the research of Magana (2017) and empowers my decision to base my PD curriculum in collaborative, supportive methods.

Above all, the most significant finding in their research for my purposes was the absolute necessity for forming faculty learning communities where participants held a shared vision and overall goal. Following the group structure set forward by Magana (2017) will allow me to achieve this for my PD programming. Happel et al. (2020) do, however, outline the importance of a clear leader in each group who "might take responsibility for a variety of tasks, including organizing meetings and distributing tasks within the group" (p. 64). This is important for me to note moving forward in my planning stages but also compliments my original line of thinking that ensuring training and facilitation are teacher-led is paramount to the success of my programming.

Carpenter and Fitzmaurice's (2018) research focused on the assessment of collegial communities and presented an interesting take on terminology. They stated that they "intentionally use the term 'faculty support' to describe activities that are often called faculty development" (Carpenter & Fitzmaurice, 2018, p. 90) suggesting that faculty development may actually be outdated and that using the term faculty support instead may immediately foster a different perception from participants.

Carpenter and Fitzmaurice (2018) described an anecdotal experience of a new teacher joining an educational institution and juggling their new assignment while feeling very much like an outsider on the overall educational team. They suggested that when given the opportunity to share and hear others' stories of vulnerability within their faculty teams, including senior ranking members, new-to-the-team educators can see their colleagues in a more human light. As a result of this, it allows them to both know and trust their new team, rendering them more able to openly reflect on their teaching

practices. This is useful for me in my planning stages because it has forced me to acknowledge the stages even before creating an established faculty learning community, that it really begins with the school culture as a whole. Though whole-school culture is difficult to consider for its large scale and potential lack of malleability, it is evident to me from their research that this must be a consideration of mine, in addition to the actual formation of my learning groups.

Finally, as my last review of the literature surrounding faculty learning communities, I consulted the research of Horrocks and Trust (2017) which sought to find a solution to the loneliness of teachers. I was immediately interested as I hope to foster a sentiment of inclusion and belonging for all my PD participants in relation to the implementation of technology in their classrooms. Their research findings were supported by "a qualitative study that examined teachers' experiences in a blended community of practice through in-depth interviews with 26 K-12 teachers" (p. 645). Certainly, this piqued my interest as a high-value source of data from which to plan my own PD curricula.

Horrocks and Trust (2017) made use of the term "communities of practice" throughout their research instead of faculty learning communities. However, as they defined communities of practice to be "a group of professionals who learn together and support one another in developing their practice" (Horrocks & Trust, 2017, p. 645), I have determined that the concept of a safe, reflective learning space for educators with a common goal remains the same between both communities of practice and faculty learning communities. This is confirmed by Horrocks and Trust as they stated, fostering

"critical reflection and communicative learning can facilitate changes in teachers' beliefs and practices" (p. 646).

Integral to my research are their findings that "professional development activities featuring collaboration, teacher-driven inquiry and agency … have transformative potential" (Horrocks & Trust, 2017, p. 646). Further still, Horrocks and Trust (2017) found that transitioning teacher learning communities online helped teachers "build their networks beyond their face-to-face contacts, receive emotional support, overcome isolation, seek advice and access new knowledge and ideas for improving their practice" (p. 647). From the surveys of existing literature on faculty learning communities, I can move forward with confidence that centering my PD curricula around group learning that is teacher-led with a hybrid facilitation method will be significantly effective.

Critical Friend Group Model

Though I felt very affirmed in my plan to create online faculty learning communities to facilitate my PD curricula, while I was researching these groups and the best ways to generate them, I came across the terminology critical friends' groups. With a sizable amount of my search using my key terms bringing about research surrounding this model, I felt it prudent to consult a base from which to learn from and perhaps find ways to incorporate it into my PD planning.

The first piece of research I consulted was Able et al. (2018) which identified the need for continual support systems and ongoing PD training as a crucial issue for new teachers. Their study centered around the experiences of new teachers who are participating in support groups that meet several times per academic year, modeled after

the critical friends' group format. This seems very similar to the origin of faculty learning communities and is thus relevant to my research.

They iterated that critical friend groups provide teachers with "a safe context in which to reflect on their practice through supportive collegial interactions" (Able et al., 2018, p. 204). Further, they noted that critical friend groups are long-term support systems extending past induction programs which are limited in scope and, perhaps, they submitted, not particularly valuable as new teachers are learning on the job. While all this information is useful and certainly underpins the necessity of safe, reflexive spaces from which teachers can learn and feel supported enough to implement new teaching methodologies - like the use of technology - still, I was unable to differentiate between the critical friend group model and that of faculty learning communities.

Therefore, I consulted further research, including Wennergren (2016). In their research Wennergren, similar to Able et al. (2018) and the body of research supporting faculty learning communities, outlined the importance of collaborative professional learning opportunities for teachers. The author stated that the "concept of critical friends rests on the premise that schools cannot be intellectually engaging places for students unless their teachers are likewise engaged in their own learning community" (Wennergren, 2016, p. 261). This links strongly to the framework of learning put forward for learners in Magana's (2017) model for achieving technology transcendence. Upon understanding the differences between the two models outlined by Wennergren, it became important for me to understand the potential benefits of pairs of teachers over groups of teachers.

However, none of the research readily available seemed to address this question: why would teacher pairs be superior to teacher-learning groups? Most research, including Blake and Gibson (2021) continued to outline the absolute importance of safe, judgment free, collaborative learning spaces for teachers to explore new methodologies. While this certainly supports my prospective model, I am left wondering more about critical friends and their application.

Blake and Gibson (2021) did however provide further explanation of the procedural workings of critical friends' groups. They state that these groups must meet regularly and are obligated to follow a specific protocol which includes the "presentation of a professional dilemma" (Blake & Gibson, 2021, p. 138) that is then unpacked by the group in a non-evaluate manner with collective thought utilized to brainstorm solutions. Following this discussion, the educator who presented the dilemma must "report back ideas they found useful" (Blake & Gibson, 2021, p. 139). Still, this procedure mimics Magana's (2017) group formation and procedures, if only with slightly fewer details surrounding the brainstorming of the solution phase.

Blake and Gibson (2021) stated that unlike previous learning group models, the presenter of the dilemma is prohibited from participating or contributing in any form to the follow-up discussion. This seemed particularly unorthodox to me, but they found that this reduced "defensive responses, and emerging atmospheres of discord" (Blake & Gibston, 2021, p. 140). This particular aspect of the critical friend group model is interesting to my planning and forced me to confront an obvious question regarding my ability to reduce or eliminate animosity and defensiveness in my learning groups.

Carlson (2019) conducted a qualitative study surrounding the role of critical friend groups through various methods including both interviews and observations. They stated that, in general, “effective teaching is constructed as a solitary, soul-searching, test of survival” (Carlson, 2019, p. 1) and that a focus on developing interpersonal reflection skills is highly needed. Comparing this to the data I collected in my research, the relation is clear. To develop interpersonal reflection skills, Carlson discussed the concept of reflective teaching journals and their place in collaborative learning communities. They stated that incorporating this activity into learning communities has enhanced the effectiveness of the communities as a whole. It is an interesting extension of collaborative spaces I may consider applying to my own professional curriculum development.

One important downfall of the critical friend model was that some participants felt overshadowed and under-appreciated. One participant stated that while she was an active participant in the group, she “received very little, if any feedback, from her group members, on her submissions” (Carlson, 2019, p. 8). Another criticism from participants was having to collaborate with teachers outside their content areas. One participant stated that it was “hard to discuss experiences because each of us came from different content areas and didn’t really have much to say on how to help each other” (Carlson, 2019, p. 8). This is useful criticism for me in my planning stages, if not completely relevant to the critical friend group model. Now, I am aware that I must ensure all participants are equally as active, are receiving equal amounts of feedback, and perhaps rethink the idea put forward by Dancy et al. (2019) that collaborative learning groups, when facilitated online, can and should attempt to be both content and geographically diverse.

Overall, my study surrounding critical friend groups was certainly informative, if not completely useful. Though I may not choose to adopt the process principles of critical friend groups, the discussions surrounding participants' experienced weaknesses of collaborative learning spaces with fellow teachers were relevant and something I will keep in mind while structuring my learning program and system. I have additionally identified the comparison of paired teacher learning groups compared to small group teacher learning groups to be an interesting focal point for future research as there does not seem to be a significant amount of literature surrounding this difference.

Project Description

Potential Resources

The project is a self-directed, collaborative online PD curriculum that has three modules, each focused on Kahoot, Alef, and Quizlet. They will be hosted on the school's existing LMS platform, which in this case is Google Classroom, and will require access to the LMS. The modules (see Appendix A) have been developed by me and will be posted on a pre-scheduled basis during their Professional Learning Community time each month, with each module taking approximately 5-7 hours for teachers to complete between meetings. The learners in each module will be the teachers from both PTMS and DSMS who will be organized into interdisciplinary peer groups, where different subject teachers will be completing the modules and communicating with each other accordingly.

Roles and Responsibilities

The role of the learners in this program will simply be to move through each module, completing assigned tasks including learning activities, application assignments,

discussions, assessments, and evaluations. However, before teachers begin going through these modules, a staff meeting will be held with a PowerPoint presentation to discuss them, as well as the expected completion. Moreover, teachers will provide feedback on each module, which will assist in improving future training sessions.

Potential Barriers and Solutions

The potential barriers to this PD course are limited as it is a self-directed program for teachers and therefore the potential for scheduling conflicts is eliminated. There is, however, a potential barrier in that teacher engagement on discussion boards could be limited. To stimulate meaningful learning and accountability, the school's technology coach will act as the course facilitator with the goal of encouraging both participation and rich discussion with directed questions, if necessary. It is critical that teachers feel these discussion boards are a safe place to express both their positive and negative experiences, so the discussion is authentic. Each discussion board will include an introduction reminding them that their participation is not being evaluated in any way and that this is a safe place to grow and learn about the technologies together as a cohort. An additional barrier might be teachers who find themselves struggling to keep up with the pace of the learning schedule. To mitigate this, all efforts have been made to make each module one that teachers can leave and come back to if time is limited. There is no need to complete the entirety of each task in one sitting; teachers can add their contributions as their schedule allows.

Implementation Proposal and Schedule

Before the faculty begin the PD, it would be introduced at each school at a faculty meeting. It would be explained that the training is optional and designed based upon what they indicated in their interviews or questionnaires they completed for this project. It would be optional so that each professional learning group could decide to complete it or choose something else. Appendix H exhibits the implementation of the proposed schedule and outline of each module. The faculty would be asked to dedicate between half an hour up to two hours per week during the PD program.

Project Evaluation Plan

The structures of evaluation for this training course will be peer feedback in the discussions and classroom practice, and by completing the reflection questionnaire at the conclusion of each learning module. More specifically, after each week of staff meetings and discussion, participating teachers will be given the opportunity to complete a confidential survey rating their experiences, and any concerns or issues with the modules. Specifically, teachers will be asked to evaluate previous methods of activating student schemata, concept review and formative assessment with the new methods using each learning application. Like other schools that have structured their technology PD using the T3 framework (Magana, 2017), this project will use the reflection questionnaire at the end of each module to evaluate teachers' personal technology skill growth (Atallah et al., 2006). The reflection questionnaire will be used as feedback to make changes and improvements to each module. Another form of evaluation will be the feedback that teachers receive from their peers, similar to a form of evaluative feedback used by Aspire

Public Schools when they implemented the T3 framework in their schools. (“Transforming Teacher Talent (T3) System,” 2015).

The purpose of using reflective-based evaluation is to illuminate the teacher’s personal progress toward self-efficacy. This progress cannot be measured as a whole as it pertains specifically to each teacher. This evaluation seeks to be mindful of this personal growth by tracking it through reflective activities. The key stakeholders in the evidence obtained from the project’s evaluation are the school’s administrative team who desires to see more technology embedded into classroom instruction. This might include teaching and learning coaches, academic heads of departments, and other senior leadership team members. The evidence gathered from the evaluations will be useful to further guide technology training and implementation in their school.

Overall, the evaluation goals are to track the personal journeys of the participating teachers and to evaluate if they can more effectively integrate game-based technology assessment tools in the classroom. Teachers will report on how they interacted with the three technological tools (Alef, Kahoot, and Quizlet) and showcased an increase in self-efficacy while utilizing the tools. By using evaluative strategies that allow teachers space to reflect and provide thoughts on their progress, the evaluation data can be used to make improvements to the PD.

Project Implications

The potential implications for positive social change from the project may include an improvement in technology utilization for middle school teachers using game-based technologies in the Abu Dhabi region. Should the evidence gathered from the evaluation

tools of this project show an increase in positive feelings, efficacy, and implementation of technology tools by teachers, the PD programming throughout the local school communities and districts could be shifted to incorporate the tenets of T3 transcendence (Magana, 2017). Traditional models of K-12 PD have not made a significant impact for improving classroom teachers' pedagogy. This project is innovative in that it provides PD in a high-need area that is ongoing and supported by their colleagues. Typically, a school PD Day is a one-time event that provides instruction, but no follow-up and little choice in what the required PD will be (Koonce et al., 2019). This project study will provide a new method for PD that allows educators to learn a technology tool starting from its basic functions, and then scaffold the learning to eventually be able to utilize the technology tool to its fullest potential.

In a larger context, realizing this model of PD as effective, as measured by reflective data provided by teachers themselves, may provide a new model to be utilized not only for technology training but all PD in public schools. Moreover, this research can be circulated to school districts through principal workshops and PD sessions, or academic presentations, for them to make use of the PD online course as a model of effective PD. Between this dissemination and potential transformational vehicle for PD modification as a whole, the prospective for social change resulting from this research is likely.

Section 4: Reflections and Conclusions

Project Strengths and Limitations

The strengths of this project are centered around two key aspects: self-direction and collaboration. According to the T3 transcendence model, learners must be able to identify and investigate issues independently, without outside influence from a trainer (Magana, 2017). By guiding learners through self-directed models where they must identify aspects of their lesson plans to adjust after engaging with explanatory material on each technological tool, teachers are responsible for identifying their needs and investigating the benefits of application direction. Moreover, by providing online discussion boards where teachers must engage with one another, the project has incorporated the key tenets of the critical friend group model including the creation of a continual support system (Able et al., 2018) made up exclusively of teaching peers, not impacted or policed by the schools' leadership team.

The overall project deliverable may have large-scale implications in creating a new approach to teacher training. Nonetheless, the project is limited due to the small geographical and cultural region where both the preliminary research and implementation of the project occurred. As a result of the location of participants throughout the project, it is not possible to deem findings universally applicable.

Recommendations for Alternative Approaches

While in this project, I focused on using the T3 transcendence model (Magana, 2017) to increase teacher self-efficacy, there are alternative approaches that could have been used to address the problem of lack of technology use in classrooms. A curriculum

plan that deals with the problem of lack of technology use could have been developed for preservice teachers as mandatory modules in university or college preparatory degrees. In this way, teachers would be exposed to technological tools as a necessity and given both the practical and cognitive skills needed to approach new technology platforms as they encounter them in their teaching careers. I did not choose this approach to new technology platforms for this project as it would have been much more difficult to evaluate effectiveness due to the long-time range of the project and approval that would have been needed from different university or college bodies. To evaluate the effectiveness of new technology platforms, project participants would need to be tracked over the course of several years from preservice to well into their teaching careers.

Additionally, this online PD could have been provided in its suggested format over short-term breaks, such as spring or winter break. However, this format was not selected due to the data collected during the research stages that showed teachers' disapproval of being expected to learn and participate in PD activities outside their contractual hours. The goal of this PD is to increase teachers' positive reactions to new game-based technology assessment tools and their integration into their classrooms and to increase student engagement and academic achievement.

Scholarship, Project Development and Evaluation, and Leadership and Change

As an educator and senior leadership team member with 23 years of experience in teaching and learning, I was quite familiar with both teacher and administrator concerns regarding the lack of technology use in classrooms despite widespread availability. However, I had not encountered formal research conducted to address this gap from the

perceptions of teachers. Although I had spent many years being a teacher, I had never conducted any formal qualitative research due to the lack of integration of technology in classroom instruction to engage student learning and academic achievement. From completing several literature reviews on the integration of technology, albeit not to this scope, I was most interested in conducting interviews, formal questionnaires and analyzing the data.

Throughout the development of the project, I gained extensive knowledge on not only how to conduct a questionnaire of this size but how to analyze the resulting data using themes and coding systems. Prior to this experience, I did not understand how qualitative data are used for informing program planning, and I may not have ever been encouraged to use this strategy. Learning to pay attention to minute details that impact my planning is a lesson I will take forward into my continuing career in education.

My growth as a leader in the educational sphere has been exponential. I learned a lot about the current experience of teaching in technology-influenced classrooms today. Moving forward, I will be more mindful of the desires of teachers and certainly lean on the T3 transcendency model to make training sessions more appropriate and more effective for my teachers.

Reflection on the Importance of the Work

The importance of this study from the outset to project design and implementation has been the identification of the problem of teachers not implementing technology in their classrooms in an organized, non-blaming way. In general, the finger is often pointed at teachers for not using technology despite its accessibility. However, little has been

done to provide a voice for teachers to explain their experiences, hesitations, and challenges. By creating a study that allowed teachers to reflect and speak honestly without fear of reprisal from their superiors, a body of clear, non-accusatory factors limiting technology implementation in classrooms has been accumulated. These data have empowered the creation of a PD program catered to the needs of teachers as identified by teachers. This is important due to the quick and consistent progression of technology in students' lives. Teachers need enhanced mechanisms to keep up with the pace of technology development and entrenchment into the daily lives of learners both to suit their learners and to fully benefit as educators from their use. By combining teacher voices with the principles of T3 transcendence, which empowers learners to be in the driver's seat of their own technological journey, I learned that self-efficacy is derived from being heard and allowed to experiment in a safe and supportive environment.

Implications, Applications, and Directions for Future Research

Describing the potential impact for positive social change at the appropriate level, the project has several streams of influence that may be impactful to promote positive social change. Such influences may include but are not limited to individual, family, organizational, and societal/policy. Not only does the project's low-risk, self-paced training enhance the accessibility of technological programs to teachers while balancing their concerns outlined in the questionnaire data, but it may have a positive impact on their student's experience in the classroom. By providing mechanisms through which teachers can utilize technology in their classrooms more easily and authentically, students stand to reap the intended benefits of these technological tools. Similarly, on more wide-

ranging levels, parents will see an improvement in student engagement, and familiarity with technology while administrators will see reduced teacher stress levels and their classrooms utilizing technology tools available. Moreover, administrators can expect teachers to approach new technology platforms with enhanced ease as a formula for experimentation, peer-support and transcendence has been established.

On a theoretical level, the project will prove that the T3 transcendence model is an appropriate instructional strategy for technology, as well as support the learning model for learners. The implication being that principles of T3 transcendence may be modified to fit any subject matter and target any learner to increase acquisition of new target skills. Building upon this, future research should focus on developing PD models in the field of education, while incorporating these principles into other learning spheres, which could include instructional approaches such as assessment for learning or behavioral management techniques such as relationship building, providing positive feedback, and monitoring student's social-emotional learning progress.

Conclusion

Technology, computers, applications, and online platforms are prolific in both their expansion and impact on students' lives and experiences in the classroom. They offer new motivational streams and provide more access to deeper meanings than ever before (Cuban, 2001). For teachers, this new era of technology-embedded education has brought benefits but also downfalls. The largest downfall is that of effective integration. In this project study, I identified teachers' largest, self-identified obstacles in implementing these new tools in their classroom and as a result of the data collected,

have developed a PD training program centered around alleviating these obstacles. Using the T3 transcendency model (Magana, 2017), the training program is focused on being teacher-centered, collaborative, and reflective with the overall goal of increasing teachers' positive reception and self-efficacy of these technological tools.

References

Alaswad, Z., & Nadolny, L. (2015). Designing for game-based learning: The effective integration of technology to support learning. *Journal of Educational Technology Systems, 43*(4), 389–402. http://doi.org/10.1177/0047239515588164

Aldarayseh, A. (2020). The impact of COVID-19 pandemic on modes of teaching science in UAE Schools. *Journal of Education and Practice*. https://doi.org/10.7176/JEP/11-20-13

Alef Education. (2020, March 22). Alef Education's digital learning platforms [Video]. YouTube. https://youtu.be/fXTHFB8415U

Alef Education. (2021a). Engaged learning experiences for the 21st century learner. https://www.alefeducation.com

Alef Education. (2021b, May 26). Alef platform [Video]. YouTube. https://www.youtube.com/watch?v=yoLIVRglCZ4

Alenezi, A. (2017). Obstacles for teachers to integrate technology with instruction. *Education & Information Technologies, 22*(4), 1797–1816. https://doi.org/10.1007/s10639-016-9518-5

Almekhlafi, A. G., & Almeqdadi, F. A. (2010). Teachers' perceptions of technology integration in the United Arab Emirates school classrooms. *Journal of Educational Technology & Society, 13*(1), 165–175. http://www.jstor.org/stable/jeductechsoci.13.1.165

Alsuhaymi, D., & Alzebidi, A. (2019). Saudi teachers' perceptions regarding adopting digital games in teaching practice. *Turkish Online Journal of Educational*

Technology, 18(4), 62–69. https://eric.ed.gov/?id=EJ1232268

An, Y., & Cao, L. (2017). The effects of game design experience on teachers' attitudes and perceptions regarding the use of digital games in the classroom. *TechTrends 61*(2), 162–170. https://doi.org/10.1007/s11528-016-0122-8

Balta, N., & Eryılmaz, A. (2019). The effect of the 'teacher-led PD for teachers' professional development program on students' achievement: an experimental study. *Teacher Development, 23*(5), 588–608. https://doi.org/10.1080/13664530.2019.1659176

Bandura, A., Freeman, W. H., & Lightsey, R. (1999). Self-efficacy: The exercise of control. *Journal of Cognitive Psychotherapy, 13*(2), 158–166. https://doi.org/10.1891/0889-8391.13.2.158

Bashir, M., Afzal, M. T., & Azeem, M. (2008). Reliability and validity of qualitative and operational research paradigm. *Pakistan Journal of Statistics and Operation Research, 4*(1), 35–45. https://doi.org/10.18187/pjsor.v4i1.59

Bergström, P., & Mårell-Olsson, E. (2018). Power and control in the one-to-one computing classroom: Students' perspectives on teachers' didactical design. *Seminar.net, 14*(2), 160–173. https://doi.org/10.7577/seminar.2972

Bicen, H., & Kocakoyun, S. (2018). Perceptions of students for gamification approach: Kahoot as a case study. *International Journal of Emerging Technologies in Learning, 13*(02), 72–93. https://doi.org/10.3991/ijet.v13i02.7467

Blake, J., & Gibson, A. (2020). Critical friends group protocols deepen conversations in collaborative action research projects. *Educational Action Research, 29*(1), 133–

148. https://doi.org/10.1080/09650792.2020.1717568

Boss, S., & Krauss, J. (2008). Reinventing project-based learning: Your field guide to real-world projects in the digital age. *School Library Journal, 54*(10), 78. https://eric.ed.gov/?id=ED498132

Carlson, J. R. (2019). "How am I going to handle the situation?" The role(s) of reflective practice and critical friend groups in secondary teacher education. *International Journal for the Scholarship of Teaching and Learning, 13*(1). https://eric.ed.gov/?id=EJ1203799

Carpenter, R. L., & Fitzmaurice, C. (2018). Assessment and faculty support: Fostering collegial community to strengthen professional practice. *Journal of General Education, 67*(1–2), 90–108. https://doi.org/10.5325/jgeneeduc.67.1-2.0090

Carver, L., & Todd, C. (2016). Teacher perception of barriers and benefits in K–12 technology usage. *Turkish Online Journal of Educational Technology, 15*(1), 110–116. https://eric.ed.gov/?id=EJ1086185

Çoklar, A., Çoklar, A., Efilti, E., Şahin, Y., & Akçay, A. (2016). Determining the reasons of technostress experienced by teachers: a qualitative study. *Turkish Online Journal of Qualitative Inquiry, 7*(2), 71–96. https://api.semanticscholar.org/CorpusID:147858849?utm_source=wikipedia

Corbin, J., & Strauss, A. (2008). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (3rd ed.). Sage.

Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches* (4th ed.). Sage.

Cuban, L. (2001). *Oversold and underused: Computers in the classroom.* Harvard University Press.

Dancy, M., Lau, A. C., Rundquist, A., & Henderson, C. (2019). Faculty online learning communities: A model for sustained teaching transformation. Physical Review Physics Education Research, 15(2). https://eric.ed.gov/?id=EJ1236612

Davis, F. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319-340. https://doi.org/10.2307/249008

De Los Arcos, B., Faems, B., Comas-Quinn, A., & Pulker, H. (2017). Teachers' use and acceptance of gamification and social networking features of an open repository. European Journal of Open, Distance and E-Learning. 20. https://eric.ed.gov/?id=EJ1187840

Dele-Ajayi, O., Strachan, R., Anderson, E. V., & Victor, A. M. (2019, October). Technology-enhanced teaching: A technology acceptance model to study teachers' intentions to use digital games in the classroom. IEEE Frontiers in Education Conference, 1-8. https://doi.org/10.1109/FIE43999.2019.9028527

Devers, C. J., & Gurung, R. A. (2015). Critical perspective on gamification in education. In T. Reiners & L.C. Wood (Eds.), In Gamification in education and business (pp. 417-430). Springer. https://link.springer.com/book/10.1007/978-3-319-10208-5?

Dich, L., Browns, K. M., Kuznekoff, J. H., Conover, T., Forren, J. P., & Marshall, J. 2017. Growing lemon trees from lemons: Lessons reaped from a SoTL faculty learning community's research 'failures.' Journal of the Scholarship of Teaching

and Learning 17(4), 1–16. https://doi.org/10.14434/josotl.v17i4.21377

Dikmen, C. H., & Demirer, V. (2016). Investigation of the variables affecting teachers' behaviors towards technology integration. Inonu University Journal of the Faculty of Education, 17(3), 153–167. https://search.trdizin.gov.tr/tr/yayin/detay/248853/

Donovan, L., Green, T., & Hartley, K. (2010). An examination of one-to-one computing in the middle school: Does increased access bring about increased student engagement? Journal of Educational Computing Research, 42(4), 423–441. https://journals.sagepub.com/doi/10.2190/EC.42.4.d

Dube, S. (2017). Educators' pedagogical concerns on blending ICTs in teaching. Proceedings of the European Conference on Games Based Learning, 150–155. https://www.proquest.com/openview/aac78d8588df45ed5c0ed7ddaed9abe9/1?pq-origsite=gscholar&cbl=1796419

EDUCAUSE. (2014). 7 things you should know about games and learning. ELI. https://library.educause.edu/-/media/files/library/2014/3/eli7106-pdf.pdf

Çoklar, A., Efilti, E., Şahin, Y., & Akçay, A. (2016). Determining the reasons of technostress experienced by teachers: A qualitative study. Turkish Online Journal of Qualitative Inquiry, 7(2), 71-96. https://api.semanticscholar.org/CorpusID:147858849

Erfurth, M., & Ridge, N. (2020). The impact of COVID-19 on education in the UAE. Sheikh Saad Bin Saqr Al Qasimi. Strategic Report, 1, 1-15. https://www.researchgate.net/publication/343551412_The_Impact_of_COVID-19_on_Education_in_the_UAE

Farid, S. (2021). UAE top performer in EdTech, focus on innovation. Edarabia. https://www.edarabia.com/uae-top-performer-edtech-innovation/

Frazier, D. K., & Trekles, A. M. (2018). Elementary 1:1 iPad implementation: Successes and struggles during the first year. Journal of Educational Technology Systems, 46(4), 463-484. https://eric.ed.gov/?id=EJ1179514

Glaser, B. G., & Strauss, A. (1967). The discovery of grounded theory: Strategies for qualitative research. Aldine.

Gomillion, D., Becker, A., George, J., & Scialdone, M. (2020). Learning how to teach: The case for faculty learning communities. Information Systems Education Journal, 18(4), 74–79. https://files.eric.ed.gov/fulltext/EJ1258233.pdf

Happel, C. A. C., & Xiaomei S. (2020). Facilitators and barriers to engagement and effective SoTL research collaborations in faculty learning communities. Teaching & Learning Inquiry, 8(2), 53–72. https://doi.org/10.1186/s13033-020-00392-5

Harrell, S., & Bynum, Y. (2018). Factors affecting technology integration in the classroom. Alabama Journal of Educational Leadership, 5, 12–18. https://eric.ed.gov/?id=EJ1194723

Harris, L. R., & Brown, G. T. L. (2010). Mixing interview and questionnaire methods: Practical problems in aligning data. Practical Assessment, Research & Evaluation, 15(1), 1-19. https://scholarworks.umass.edu/cgi/viewcontent.cgi?article=1227&context=pare

Heath, M. K. (2017). Teacher-initiated one-to-one technology initiatives: How teacher self-efficacy and beliefs help overcome barrier thresholds to implementation.

Computers in the Schools, 34(1), 88–106. https://doi.org/10.1080/07380569.2017.1305879

Howard, S. K., & Mozejko, A. (2015). Teachers: Technology, change, and resistance. Faculty of Social Sciences Paper. 1830. https://ro.uow.edu.au/sspapers/1830

Ishak, N. M., & Bakar, A. Y. A. (2014). Developing sampling frame for case study: Challenges and conditions. World Journal of Education, 4(3), 29-35. https://files.eric.ed.gov/fulltext/EJ1158705.pdf

Explore the ISTE Educator Standards. (2018). International Society for Technology in Education. https://www.iste.org/standards/for-educators

Joo, Y. J., Park, S., & Lim, E. (2018). Factors influencing preservice teachers' intention to use technology: TPACK, teacher self-efficacy, and technology acceptance model. Journal of Educational Technology & Society, 21(3), 48–59. https://www.jstor.org/stable/26458506

Kahlke, R. M. (2014). Generic qualitative approaches: Pitfalls and benefits of methodological mixology. International Journal of Qualitative 13, 37-52. https://doi.org/10.1177/160940691401300119

Kamişli, H. (2019). On primary school teachers' training needs in relation to game-based learning. International Journal of Curriculum and Instruction 11(2), 285-296. http://orcid.org/0000-0001-6715-431X

Koonce, M., Pijanowdki, E., Bengtson, Ed., & Lasater, K. (2019). Principal engagement in the professional development process. NAASP Bulletin, 103(3). 229-252. https://doi.org/10.1177/0192636519871614

Lambirth, A., Cabral, A, & McDonald, R. (2019). Transformational professional development: (Re)claiming agency and change (in the margins). Teacher Development: An International Journal of Teachers' Professional Development, 23(3). 387-405. https://doi.org/10.1080/13664530.2019.1605407

Lambirth, A., Cabral, A., McDonald, R., Philpott, C., Brett, A., & Magaji, A. (2021). Teacher-led professional development through a model of action research, collaboration and facilitation. Professional Development in Education, 47(5), 815–833. https://doi-org.libconnect.ku.ac.ae/10.1080/19415257.2019.1685565

Landers, R. N., & Landers, A. K. (2014). An empirical test of the theory of gamified learning. Simulation & Gaming, 45(6), 769–785. https://doi.org/10.1177/1046878114563662

Lawless, K. A., & Pellegrino, J. W. (2007). Professional development in integrating technology into teaching and learning: Knowns, unknowns, and ways to pursue better questions and answers. Review of Educational Research, 77(4), 575–614. https://api.semanticscholar.org/CorpusID:55532188

Lestari, N. N., & Indrasari, S. Y. (2019). Teachers' adoption of 1:1 iPad implementation in the classroom. Interactive Technology and Smart Education, 16(3), 278–299. https://doi.org/10.1108/ITSE-06-2018-0041

Licorish, S. A., Owen, H. E., Daniel, B., & George, J. L. (2018). Students' perception of Kahoot's influence on teaching and learning. Research and Practice in Technology Enhanced Learning, 13(1). https://doi.org/10.1186/s41039-018-0078-8

Lin, Y.-H., & Hou, H.-T. (2016). Exploring young children's performance on and acceptance of an educational scenario-based digital game for teaching route-planning strategies: a case study. Interactive Learning Environments, 24(8), 1967–1980. http://dx.doi.org/10.1080/10494820.2015.1073745

Macias, A. (2017). Teacher-Led professional development: A proposal for a bottom-up structure approach. International Journal of Teacher Leadership, 8(1), 76–91. https://files.eric.ed.gov/fulltext/EJ1146814.pdf

Magana, S. (2017). Disruptive classroom technologies. Corwin.

Mårell-Olsson, E. & Bergström, P. (2018). Digital transformation in Swedish schools: Principals' strategic leadership and organization of tablet-based one-to-one computing initiatives. Seminar.net, 14(2), 174-187. https://doi.org/10.7577/seminar.2978

Martin, W., Strother, S., Beglau, M., Bates, L., Reitzes, T., & Culp, K. M. (2010). Connecting instructional technology professional development to teacher and student outcomes. Journal of Research on Technology in Education, 43(1), 53–74. https://doi.org/10.1080/15391523.2010.10782561

Martí-Parreño, J., Sánchez-Mena, A., & Aldás-Manzano, J. (2016). Teachers' intention to use educational video games: A technology acceptance model approach. Proceedings of the European conference on games based learning, 1, 434–441. https://doi.org/10.1080/14703297.2018.1433547

Meehan, K. K., & Salmun, H. H. (2016). Integrating technology in today's undergraduate classrooms: A look at students' perspectives. Journal of College Science Teaching, 46(1), 39-47. http://www.nsta.org/store/product_detail.aspx?id=10.2505/4/jcst16_046_01_39

Merriam, S. B., & Tisdell, E. J. (2016). Qualitative research: A guide to design and implementation (4th ed.). Jossey-Bass.

Middleton, K. V. (2020). The longer-term impact of COVID-19 on K-12 student learning and assessment. Educational Measurement: Issues and Practice, 39(3), 41–44. https://doi.org/10.1111/emip.12368

Mishra, P., & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: A new framework for teacher knowledge. Teachers College Record, 108(6), 1017-1054. https://api.semanticscholar.org/CorpusID:9440559

Nasir, S. (2019, January 13). Expect more high-tech tools in UAE schools from this year on. Khaleej Times. https://www.khaleejtimes.com/news/education/expect-more-high-tech-tools-in-uae-schools-from-this-year-on

Nousiainen, T., Kangas, M., Rikala, J., & Vesisenaho, M. (2018). Teacher competencies in game-based pedagogy. Teaching and Teacher Education, 74, 85-97. https://doi.org/10.1016/j.tate.2018.04.012

Powers, J. R., Musgrove, A. T., & Nichols, B. H. (2020). Teachers bridging the digital divide in rural schools with 1:1 computing. The Rural Educator, 41(1), 61–76. https://eric.ed.gov/?id=EJ1251505

Pressley, T. (2021). Factors contributing to teacher burnout during COVID-19. Educational Researcher, 50(5), 325–327. https://doi.org/10.3102/0013189X211004138

Puentedura, R. (2015). Learning, technology, and the SAMR model: Goals, processes, and practice [Blog post]. http://www.hippasus.com/rrpweblog/archives/2014/06/29/LearningTechnologySAMRModel.pdf

Ratnayake, I., Thomas, M., & Kensington-Miller, B. (2020). Professional development for digital technology task design by secondary mathematics teachers. ZDM: Mathematics Education, 52(7), 1423–1437. https://doi-org.libconnect.ku.ac.ae/10.1007/s11858-020-01180-8

Rizvi, A. (2021, July 6). Abu Dhabi School offers glimpse into classroom of the future. The National. https://www.thenationalnews.com/ uae/abu-dhabi-school-offers-glimpse-into-classroom-of-the-future-1.742069

Robson, K., Plangger, K., Kietzmann, J. H., McCarthy, I., & Pitt, L. (2015). Is it all a game? Understanding the principles of gamification. Business Horizons, 58(4), 411-420. https://doi.org/10.1016/j.bushor.2015.03.006

Saldaña, J. (2021). The coding manual for qualitative researchers (4th ed.). Sage Publications.

Sánchez-Mena, A., Martí-Parreño, J., & Aldás-Manzano, J. (2019). Teachers' intention to use educational video games: The moderating role of gender and age. Innovations in Education & Teaching International, 56(3), 318–329. https://api.semanticscholar.org/CorpusID:148799721

Schaffhauser, D. (2018). Questionnaire: Higher-level tech skills lacking in K-12. THE Journal. https://thejournal.com/Articles/2018/10/11/Questionnaire-Higher-level-Tech-Skills-Lacking-in-K12.aspx?p=1

Scherer, R., Siddiq, F., & Tondeur, J. (2019). The technology acceptance model (TAM): A meta-analytic structural equation modeling approach to explaining teachers' adoption of digital technology in education. Computers & Education, 128, 13-35. https://doi.org/10.1016/j.compedu.2018.09.009

Shawa, M., & Botma, Y. (2020). Practice guidelines for peer support among educators during a curriculum innovation. African Journal of Health Professions Education, 12(4), 186–190. http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S2078-51272020000400007

Shiue, Y.-M. (2007). Investigating the sources of teachers' instructional technology use through the decomposed theory of planned behavior. Journal of Educational Computing Research, 36(4), 425–453. https://doi.org/10.2190/A407-22RR-50X6-2830

Spies, R., Lee, H., Esack, I., Hollamby, R., & Viljoen, C. (2021). Learn-teach-learn: Evaluating a South African near-peer teaching programme. African Journal of Health Professions Education, 13(4), 215–217. https://doi-org.libconnect.ku.ac.ae/10.7196/AJHPE.2021.v13i4.1442

Swai, C. Z., & Glanfield, F. (2018). Teacher-led professional learning in Tanzania: Perspectives of mathematics teacher leaders. Global Education Review, 5(3), 183–195. https://eric.ed.gov/?id=EJ1193968

Tang, Q., Lei, Y., Laitochova, J., & Maresova, H. (n.d.). (2018). A bottom-UP ICT training approach for teachers. ACM International Conference Proceeding Series, 150–156. https://api.semanticscholar.org/CorpusID:51976533

Telecommunication regulatory authority. (2018). National Innovation Strategy. https://u.ae/en/about-the-uae/strategies-initiatives-and-awards/strategies-plans-and-visions/innovation-and-future-shaping/we-the-uae-2031-vision

Toyama, K. (2022, June 6). The looming gamification of Higher Ed. The Chronicle of Higher Education. https://www.chronicle.com/article/the-looming-gamification-of-higher-ed

Trust, T., & Horrocks, B. (2017). "I never feel alone in my classroom: Teacher professional growth within a blended community of practice. Professional Development in Education, 43(4), 645–665. https://api.semanticscholar.org/CorpusID:151828778

Varier, D., Dumke, E. K., Abrams, L. M., Conklin, S. B., Barnes, J. S., & Hoover, N. R. (2017). Potential of one-to-one technologies in the classroom: Teachers and students weigh in. Educational Technology Research and Development, 65(4), 967-992. http://dx.doi.org/10.1007/s11423-017-9509-2

Wennergren, A.-C. (2015). Teachers as learners – with a little help from a critical friend. Educational Action Research, 24(2), 260–279. https://doi.org/10.1080/09650792.2015.1058170

Woodbridge, A. (2014). 3 countries leading the way in classroom technology. Teachaway. https://www.teachaway.com/blog/3-countries-leading-way-

classroom-technology

Yurtseven Avci, Z., O'Dwyer, L. M., & Lawson, J. (2019). Designing effective professional development for technology integration in schools. Journal of Computer Assisted Learning, 36(2), 160–177. https://doi.org/10.1111/jcal.12394

Zakaria, N. Y. K., & Hashim, H. (2020). Game-based assessment in academic writing course for pre-service teachers. TESOL Journal 15(1), 65-73. https://files.eric.ed.gov/fulltext/EJ1257217.pdf

Appendix A: The Project

Program Outline

Below is an outline of the three-module proposed professional development curriculum to be incorporated into Palm Tree and Desert Sand Middle School's (pseudonym) teacher training programming. Modules have been created in Google Classroom in preparation for being integrated into the school's existing Google Classroom account.

Module #1: Alef (Week 1-4)

Learning Target: Learners will be able to utilize Alef as a formative assessment tool to monitor student progress with previously taught learning objectives.

Activities:

1. Video: "Alef Education's Digital Learning Platforms"
2. Video: "Alef Platform"

Materials/Equipment: Google Classroom, YouTube, personal electronic devices for teachers (phones, tablets, or laptops).

Evaluation: teacher experience and growth evaluated through their contributions to the group discussion board and from the module through Google Form exit questionnaire.

A. Introduction

Alef: Introduction

Estimated Time Needed: 1 hour
Please complete by: October 5

Hi and welcome to Module 1! This month, we will dive deep into the Alef platform with the **overall goal of being able to use it as a tool to monitor student progress with previously taught learning objectives.**

Tthis introduction includes two videos for you to watch and then reflect upon within your learning group via the discussion boards. As last week, please take note of the following while watching each of the videos:

- a. your initial impressions of the platform (two positive, two negative)
  [Remember, this can include reflections such as how students might adapt to the technology, your hesitations about the platform in general or immediate ideas of the platform might be useful to you]
- b. how were these videos was in your understanding of the platform
- c. one lingering question you have after watching

Activity 1
Video #1: "Alef Education's Digital Learning Platforms"
Watch Alef introduce it's platform and give a basic explanation of how it is used.

Activity 2
Video #2: *"Alef Platform"*
Watch Learn for Future's tutorial on how to use Alef and use it to select, assign and see the student data of different learning tasks.

Activity 3
After watching, please log into your school-assigned Alef account. Spend some time looking through the platform and investigating the features. Reflect on the following:

- d. your favourite feature of the platform
  [Remember, take a screenshot of the feature to include in the discussion board]
- e. your least favourite feature of the platform
  [Remember, take a screenshot of the feature to include in the discussion board]

Activity 4
When you have completed activities 1-3, please share your reflections (point a-e) as a class comment in the comment feature below.

Alef Education's digital learn...
YouTube video 1 minute

Alef Platform
YouTube video 11 minutes

B. Discussion

Alef: Discussion Board #2 (Task)

Estimated Time Needed: 1.5 hours
Please complete by: October 18

Hi and welcome to Module 1's task!

Activity 1
Choose an existing, upcoming lesson plan that includes a previously taught learning objective. Explain how you will rework this segment to use Alef instead of your previously planned methodology to check progress within the objective. Share your lesson plan using the following breakdown.

- a. subject, learning objective to be reviewed
- b. previously planned review approach
- c. new review approach using Alef
- d. one hesitation regarding the execution of your new plan

Please complete by: October 16

Activity 2
Please read the reflections of your group member and chose two to reply to. In your reply, please include:

- i. positive thought about new approach listed
- ii. response to the shared hesitation

Please complete by: October 18

C. Task/Discussion/Reflection

Alef: Task Reflection

Estimated Time Needed: 1.5 hours
Please complete by: October27

Hi and welcome to Module 1's task reflection board!

Activity 1
Please post your reflections on the execution of your review activity using Alef here. Please include:

- a. what went well
- b. what could have gone better
- c. review of Alef in the classroom

Please complete by: October 24

Activity 2
Please read the reflections of your group member and chose two to reply to. In your reply, please include:

- i. a suggestion how to tackle their 'what could have gone better' (b)
- ii. two things you agree with / one thing you disagree with regarding their overall review (c)

Please complete by: October 27

D. Reflection Questionnaire / Elef Survey

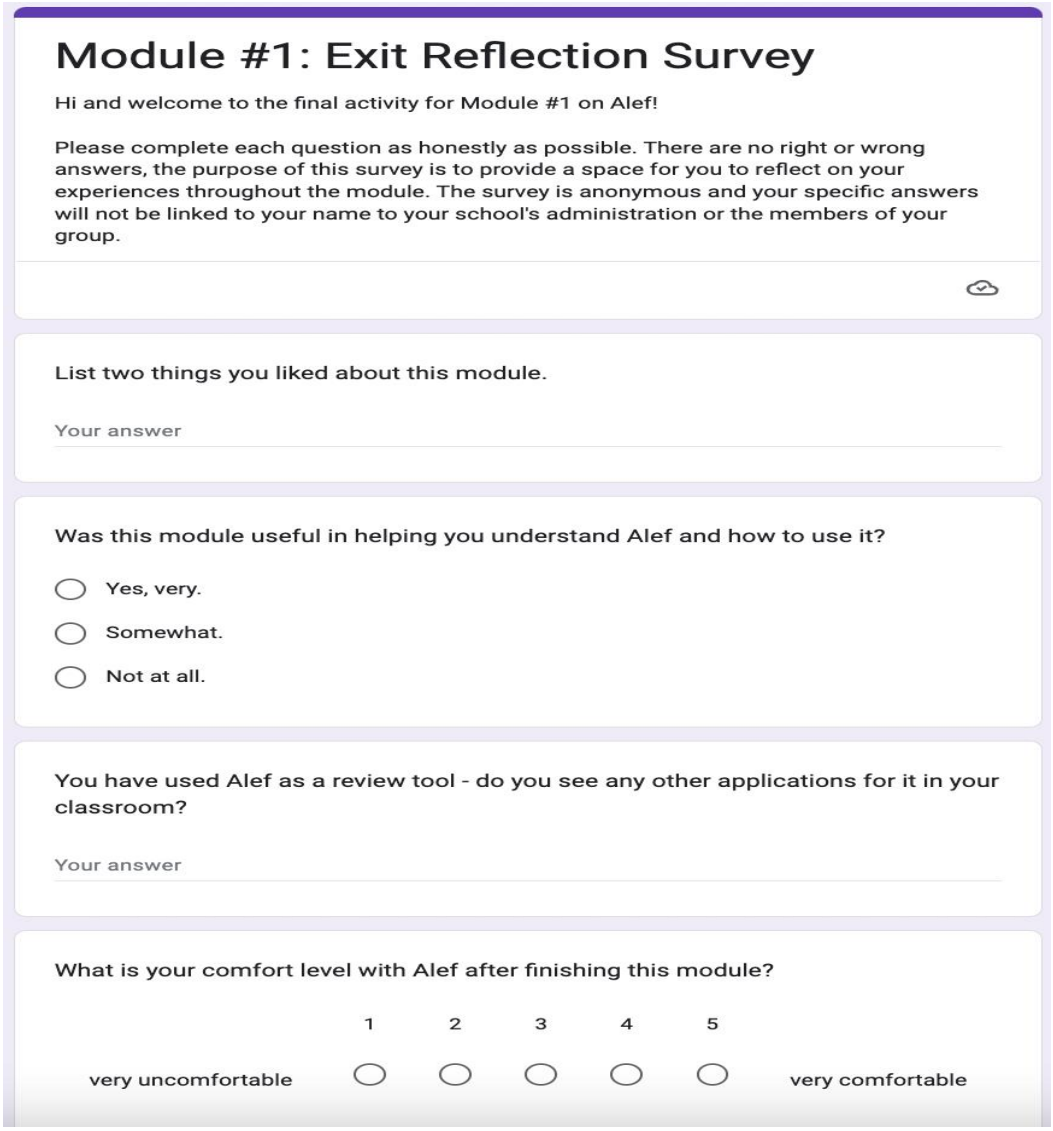
100 points

Estimated Time Needed: 0.5 hour
Please complete by: October 30

Congratulations on completing Module #1!

Please complete the attached Google Form Exit Survey. Please note you must be signed into your school Gmail account to complete the survey.

https://forms.gle/KN2u1ENh2ABzwvmu6



Module #1: Exit Reflection Survey

Hi and welcome to the final activity for Module #1 on Alef!

Please complete each question as honestly as possible. There are no right or wrong answers, the purpose of this survey is to provide a space for you to reflect on your experiences throughout the module. The survey is anonymous and your specific answers will not be linked to your name to your school's administration or the members of your group.

List two things you liked about this module.

Your answer

Was this module useful in helping you understand Alef and how to use it?

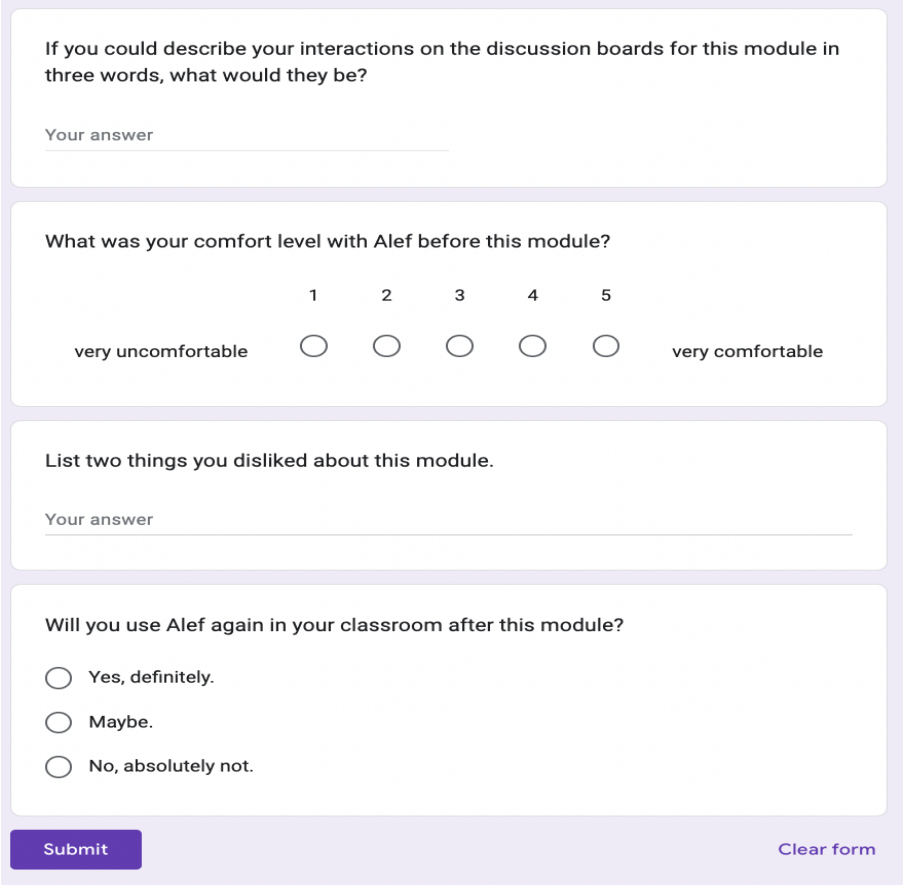
- ◯ Yes, very.
- ◯ Somewhat.
- ◯ Not at all.

You have used Alef as a review tool - do you see any other applications for it in your classroom?

Your answer

What is your comfort level with Alef after finishing this module?

	1	2	3	4	5	
very uncomfortable	◯	◯	◯	◯	◯	very comfortable



Module #2: Kahoot (Week 5-8)

Learning Target: Learners will be able to employ Kahoot as a review tool to help students recall previously taught learning objectives.

Materials/Equipment: Google Classroom, YouTube, Personal electronic devices for teachers (phones, tablets, or laptops).

Evaluation: teacher experience and growth evaluated through their contributions to the group discussion board and from the module through Google Form exit questionnaire.

A. Introduction

Kahoot!: Introduction

Estimated Time Needed: 1 hour
Please complete by: November 5

Hi and welcome to Module 2! This month, we will dive deep into Kahoot! platform with the **overall goal of being able to use it as a review tool in our classrooms.**

Like Module 1, this introduction includes two videos for you to watch and then reflect upon within your learning group via the discussion boards. As last week, please take note of the following while watching each of the videos:

- a. your initial impressions of the platform (two positive, two negative)
  [Remember, this can include reflections such as how students might adapt to the technology, your hesitations about the platform in general or immediate ideas of the platform might be useful to you]
- b. how were these videos was in your understanding of the platform
- c. one lingering question you have after watching

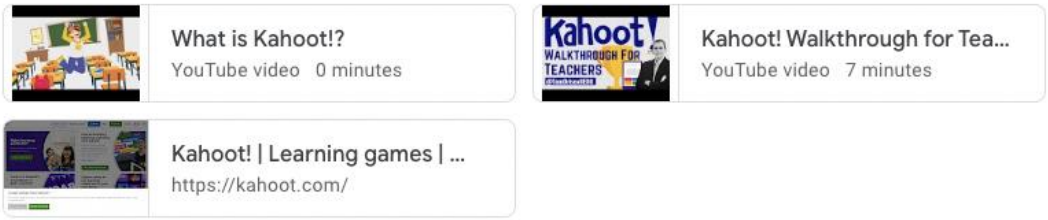
Activity 1
Video #1: *"What is Kahoot!?"*
Watch Kahoot! introduce it's platform and give a basic explanation of how it is used.

Activity 2
Video #2: *"Kahoot! Walkthrough for Teachers"*
Watch teacher Tom Driscoll's tutorial on how to login to Kahoot! and use it to create and host quiz games for your students.

Activity 3
After watching, please go to https://kahoot.com/ (also linked below) and create an account. Spend some time looking through the platform and investigating the features. Reflect on the following:

- d. your favourite feature of the platform
  [Remember, take a screenshot of the feature to include in the discussion board]
- e. your least favourite feature of the platform
  [Remember, take a screenshot of the feature to include in the discussion board]

Activity 4
When you have completed activities 1-3, please share your reflections (point a-e) as a class comment in the comment feature below.



B. Discussion

Kahoot!: Discussion Board #1

Estimated Time Needed: 1 hour
Please complete by: November 10

Hi and welcome to Module 2's discussion board! Here, we will share our initial reflections with each other, and reply to the concerns/comments of our learning group members. Remember, our **overall goal this is is to be able to use Kahoot! as a review tool in our classrooms.**

Activity 1

After completing the introduction task, please post your reflections (a-e) here. Here is a reminder of the reflection questions:

- a. your initial impressions of the platform (two positive, two negative)
  [Remember, this can include reflections such as how students might adapt to the technology, your hesitations about the platform in general or immediate ideas of the platform might be useful to you]
- b. how were these videos was in your understanding of the platform
- c. one lingering question you have after watching
- d. your favourite feature of the platform
  [Remember, take a screenshot of the feature to include in the discussion board]
- e. your least favourite feature of the platform
  [Remember, take a screenshot of the feature to include in the discussion board]

Please complete by: November 7

Activity 2
Please read the reflections of your group member and chose two to reply to. In your reply, please include:

- i. a response to their initial impressions (a)
- ii. a response to their lingering question
- iii. a question about their least favourite platform

C. Task/Discussion/Reflection

Kahoot!: Discussion Board #2 (Task)

Estimated Time Needed: 1.5 hours
Please complete by: November 18

Hi and welcome to Module 2's task!

Activity 1
Choose an existing, upcoming lesson plan that includes a review segment. Explain how you will rework this segment to use Kahoot! instead of your previously planned methodology. Share your lesson plan using the following breakdown.

- a. subject, learning objective to be reviewed
- b. previously planned review approach
- c. new review approach using Kahoot!
- d. one hesitation regarding the execution of your new plan

Please complete by: November 16

Activity 2
Please read the reflections of your group member and chose two to reply to. In your reply, please include:

- i. positive thought about new approach listed
- ii. response to the shared hesitation

Please complete by: November 18

Kahoot!: Task Reflection

Estimated Time Needed: 1.5 hours
Please complete by: November 27

Hi and welcome to Module 2's task reflection board!

Activity 1
Please post your reflections on the execution of your review activity using Kahoot! here. Please include:

- a. what went well
- b. what could have gone better
- c. review of Kahoot! in the classroom

Please complete by: November 24

Activity 2
Please read the reflections of your group member and chose two to reply to. In your reply, please include:

- i. a suggestion how to tackle their 'what could have gone better' (b)
- ii. two things you agree with / one thing you disagree with regarding their overall review (c)

D. Reflection Questionnaire

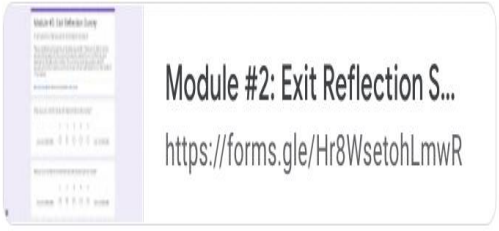
Kahoot!: Module Exit Reflection Survey

Estimated Time Needed: 0.5 hour

Please complete by: November 30

Congratulations on completing Module #2!

Please complete the attached Google Form Exit Survey. Please note you must be signed into your school Gmail account to complete the survey.



Module #2: Exit Reflection S...

https://forms.gle/Hr8WsetohLmwR

What was your comfort level with Kahoot! before this module?

	1	2	3	4	5	
very uncomfortable	◯	◯	◯	◯	◯	very comfortable

If you could describe your interactions on the discussion boards for this module in three words, what would they be?

Your answer

List two things you liked about this module.

Your answer

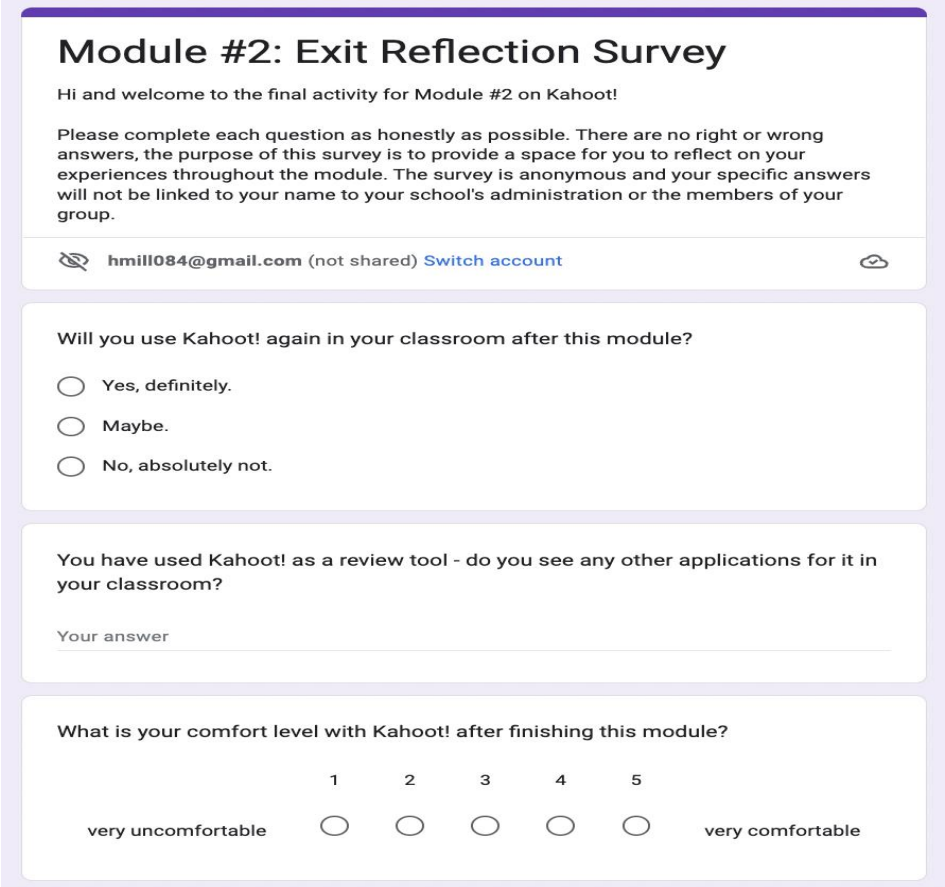
Was this module useful in helping you understand Kahoot! and how to use it?

- ◯ Yes, very.
- ◯ Somewhat.
- ◯ Not at all.

List two things you disliked about this module.

Your answer

Submit Clear form



Module #2: Exit Reflection Survey

Hi and welcome to the final activity for Module #2 on Kahoot!

Please complete each question as honestly as possible. There are no right or wrong answers, the purpose of this survey is to provide a space for you to reflect on your experiences throughout the module. The survey is anonymous and your specific answers will not be linked to your name to your school's administration or the members of your group.

hmill084@gmail.com (not shared) Switch account

Will you use Kahoot! again in your classroom after this module?

- Yes, definitely.
- Maybe.
- No, absolutely not.

You have used Kahoot! as a review tool - do you see any other applications for it in your classroom?

Your answer

What is your comfort level with Kahoot! after finishing this module?

	1	2	3	4	5	
very uncomfortable	○	○	○	○	○	very comfortable

Module #3: Quizlet (Week 9-12)

Learning Target: Learners will be able to use Quizlet to activate student schemata prior to introducing new learning objectives.

Materials/Equipment: Google Classroom, YouTube, Personal electronic devices for teachers (phones, tablets, or laptops)

Evaluation: teacher experience and growth evaluated through their contributions to the group discussion board and from the module through Google Form exit questionnaire.

A. Introduction

Quizlet: Introduction

Estimated Time Needed: 1 hour
Please complete by: December 5

Hi and welcome to Module 2! This month, we will dive deep into Quizlet! platform with the **overall goal of being able to use it as a tool to introduce new topics our classrooms.**

Like Module 1, this introduction includes two videos for you to watch and then reflect upon within your learning group via the discussion boards. As last week, please take note of the following while watching each of the videos:

- a. your initial impressions of the platform (two positive, two negative)
  [Remember, this can include reflections such as how students might adapt to the technology, your hesitations about the platform in general or immediate ideas of the platform might be useful to you]
- b. how were these videos was in your understanding of the platform
- c. one lingering question you have after watching

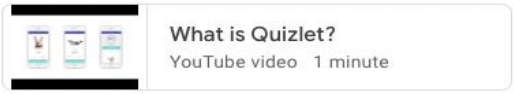
Activity 1
Video #1: *"What is Quizlet!?"*
Watch Quizlet introduce it's platform and give a basic explanation of how it is used.

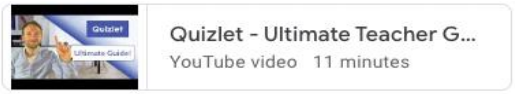
Activity 2
Video #2: *"Quizlet - Ultimate Teacher Guide!"*
Watch teacher Miss Wrexham's tutorial on how to use Quizlet and use it to create and host quiz games for your students.

Activity 3
After watching, please go to https://quizlet.com/ (also linked below) and create an account. Spend some time looking through the platform and investigating the features. Reflect on the following:

- d. your favourite feature of the platform
  [Remember, take a screenshot of the feature to include in the discussion board]
- e. your least favourite feature of the platform
  [Remember, take a screenshot of the feature to include in the discussion board]

Activity 4
When you have completed activities 1-3, please share your reflections (point a-e) as a class comment in the comment feature below.


What is Quizlet?
YouTube video 1 minute



Quizlet - Ultimate Teacher G...
YouTube video 11 minutes


Learning tools, flashcards, a...
https://quizlet.com/

B. Discussion

Quizlet: Discussion Board #1

Estimated Time Needed: 1 hour
Please complete by: November 10

Hi and welcome to Module 2's discussion board! Here, we will share our initial reflections with each other, and reply to the concerns/comments of our learning group members. Remember, our **overall goal this module is to be able to use Quizle is is to be able as a tool to introduce new topics our classrooms.**

Activity 1

After completing the introduction task, please post your reflections (a-e) here. Here is a reminder of the reflection questions:

- a. your initial impressions of the platform (two positive, two negative)
  [Remember, this can include reflections such as how students might adapt to the technology, your hesitations about the platform in general or immediate ideas of the platform might be useful to you]
- b. how were these videos was in your understanding of the platform
- c. one lingering question you have after watching
- d. your favourite feature of the platform
  [Remember, take a screenshot of the feature to include in the discussion board]
- e. your least favourite feature of the platform
  [Remember, take a screenshot of the feature to include in the discussion board]

Please complete by: December 7

Activity 2
Please read the reflections of your group member and chose two to reply to. In your reply, please include:

- i. a response to their initial impressions (a)
- ii. a response to their lingering question
- iii. a question about their least favourite platform

Please complete by: December 10

C. Task

Quizlet: Discussion Board #2 (Task)

Estimated Time Needed: 1.5 hours
Please complete by: December 18

Hi and welcome to Module 2's task!

Activity 1

Choose an existing, upcoming lesson plan that includes a new topic or learning objective. Explain how you will rework this segment to use Quizlet instead of your previously planned methodology. Share your lesson plan using the following breakdown.

- a. subject, learning objective to be reviewed
- b. previously planned review approach
- c. new review approach using Quizlet
- d. one hesitation regarding the execution of your new plan

Please complete by: December 16

Activity 2

Please read the reflections of your group member and chose two to reply to. In your reply, please include:

- i. positive thought about new approach listed
- ii. response to the shared hesitation

Please complete by: December 18

Quizlet: Task Reflection

Estimated Time Needed: 1.5 hours
Please complete by: December 27

Hi and welcome to Module 3's task reflection board!

Activity 1
Please post your reflections on the execution of your review activity using Quizlet here. Please include:

- a. what went well
- b. what could have gone better
- c. review of Quizlet in the classroom

Please complete by: December 24

Activity 2
Please read the reflections of your group member and chose two to reply to. In your reply, please include:

- i. a suggestion how to tackle their 'what could have gone better' (b)
- ii. two things you agree with / one thing you disagree with regarding their overall review (c)

Please complete by: December 27

D. Reflection Questionnaire

Quizlet: Module Exit Reflection Survey

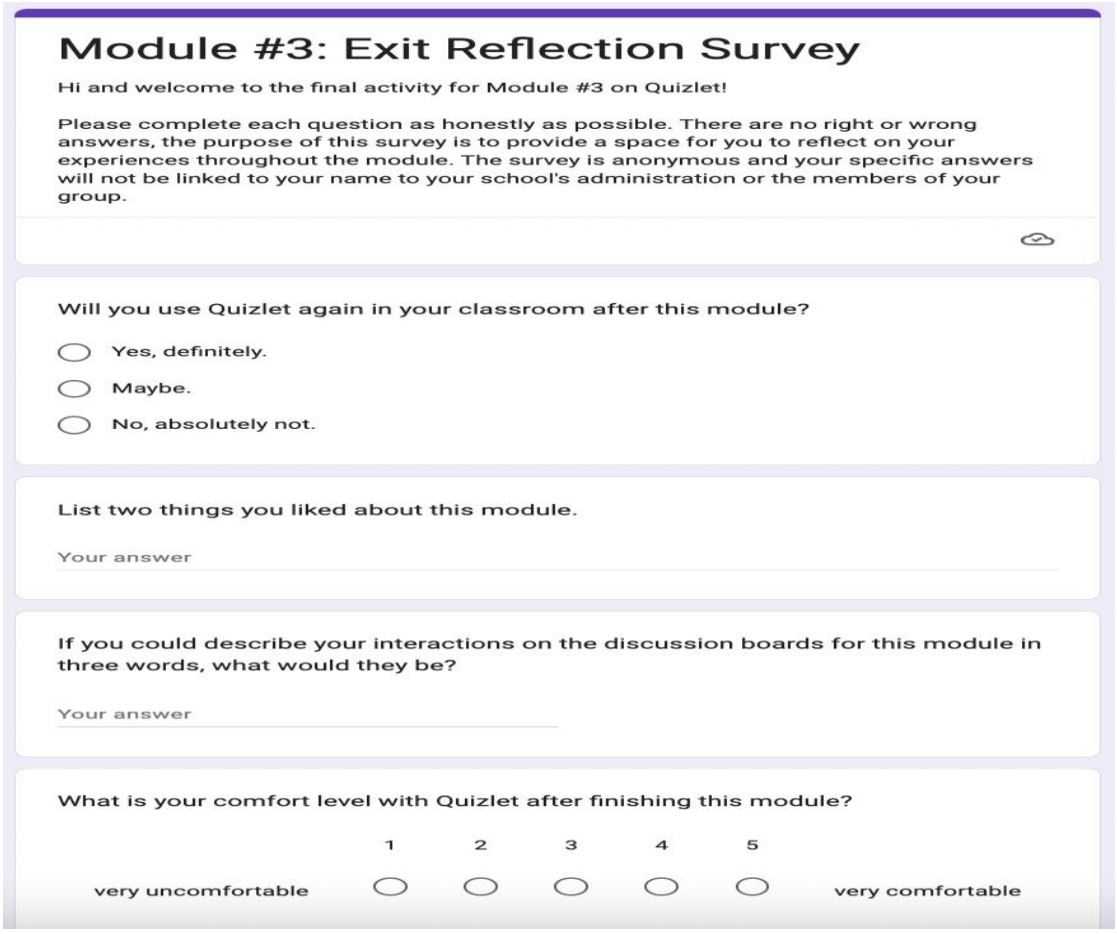
Estimated Time Needed: 0.5 hour
Please complete by: December 30

Congratulations on completing Module #3!

Please complete the attached Google Form Exit Survey. Please note you must be signed into your school Gmail account to complete the survey.

https://forms.gle/dZrQ2XudjyvpGVFP6

Module #3: Exit Reflection S...
https://forms.gle/dZrQ2XudjyvpGVF



Module #3: Exit Reflection Survey

Hi and welcome to the final activity for Module #3 on Quizlet!

Please complete each question as honestly as possible. There are no right or wrong answers, the purpose of this survey is to provide a space for you to reflect on your experiences throughout the module. The survey is anonymous and your specific answers will not be linked to your name to your school's administration or the members of your group.

Will you use Quizlet again in your classroom after this module?

- ◯ Yes, definitely.
- ◯ Maybe.
- ◯ No, absolutely not.

List two things you liked about this module.

Your answer

If you could describe your interactions on the discussion boards for this module in three words, what would they be?

Your answer

What is your comfort level with Quizlet after finishing this module?

	1	2	3	4	5	
very uncomfortable	◯	◯	◯	◯	◯	very comfortable

Appendix B: Principals' Letters of Permission to Conduct Study

Emirates Schools Establishment

مؤسسة الإمارات للتعليم المؤسسي

To: Mr. Ahmed Al Marashda, Principal

Date: 8-25-2021

Subject: Seeking permission to conduct survey in Al Tafawoq Middle School (C-2)

Respected Mr. Al Marashda,

I am writing to request permission to be able to contact the faculty at your school to conduct a study for my doctoral program. I would like to send an email invitation to invite the faculty's participation to complete either an online survey or to schedule a virtual interview. Both the survey and the interview should not take more than 30-45 minutes to complete. I will be collecting data and conducting interviews for a span of 3 weeks. The purpose of this study is to understand teachers' perceptions and opinions about using digital assessment tools for student engagement and formative assessment. Additionally, this study would like to discover the best practices teachers use to learn about these tools as well as how they are utilizing them in their teaching.

The above-said survey could help us gain better knowledge about the user's positive experience, and creative implementation of the technology in the required fields. The benefit would be the identification of strategies that could be used to improve the utilization of technology among middle school teachers in the UAE. The results of the study will be shared with each participating school.

The school's role will be limited to only forwarding the invitation to its teachers and allow any teacher who would like to participate confidentiality by completing either an online survey or a virtual interview. No data or additional documentation will be requested from your organization at any point of this study.

I look forward to a quick and positive response from your side. For any queries feel free to contact me on simone.saad@waldenu.edu, or by phone. Thank you for your consideration.

Yours Truly,

Simone Saad

971555262773

Ahmed Al Marashda

Emirates Schools Establishment

مؤسسة الإمارات للتعليم المؤسسي

To: Mr. Mohammad Al Kaabi, Principal

Date: 8-25-2021

Subject: Seeking permission to conduct survey in Tahnoon Bin Mohammed Middle School (C-2)

Respected Mr. Al Kaabi,

I am writing to request permission to be able to contact the faculty at your school to conduct a study for my doctoral program. I would like to send an email invitation to invite the faculty's participation to complete either an online survey or to schedule a virtual interview. Both the survey and the interview should not take more than 30-45 minutes to complete. I will be collecting data and conducting interviews for a span of 3 weeks. The purpose of this study is to understand teachers' perceptions and opinions about using digital assessment tools for student engagement and formative assessment. Additionally, this study would like to discover the best practices teachers use to learn about these tools as well as how they are utilizing them in their teaching.

The above-said survey could help us gain better knowledge about the user's positive experience, and creative implementation of the technology in the required fields. The benefit would be the identification of strategies that could be used to improve the utilization of technology among middle school teachers in the UAE. The results of the study will be shared with each participating school.

The school's role will be limited to only forwarding the invitation to its teachers and allow any teacher who would like to participate confidentiality by completing either an online survey or a virtual interview. No data or additional documentation will be requested from your organization at any point of this study.

I look forward to a quick and positive response from your side. For any queries feel free to contact me on simone.saad@waldenu.edu, or by phone. Thank you for your consideration.

Yours Truly,

Simone Saad

971555262773

Mohammad Al Kaabi

Appendix C: Online Questionnaire

Directions: This form contains questions to gather information about your understanding and use of game-based technology assessment tools. You are encouraged to share your honest perceptions and observations pertaining to each of the questions. Please provide a detailed answer to each question to the best of your ability. Thank you for your time and participation.

1. How many years of teaching experience do you have?
2. How would you rate your technology skills? (Novice, Intermediate, or Advanced)
3. What are your opinions about using game-based technology assessments tools for teaching and learning?
4. How do you use game-based technology assessment tools, such as Kahoot, Quizlet, and those in Alef, in your face-to-face classroom?
5. How do you use game-based technology assessment tools, such as Kahoot, Quizlet, and those in Alef in your online teaching?
6. What are your perceptions about using game-based technology assessment tools in your teaching?
7. What are your experiences with the types of training provided by your school to learn about using technology-based games?
8. Please explain how you implement Kahoot, Quizlet, or Alef in a typical lesson.
9. What is your preferred way to learn about game-based technology assessments tools?
10. What types of resources do you need to support adopting game-based technology assessments tools in your classroom?
11. What strategies can you provide for the best ways to implement game-based technology assessment tools?
12. What type of support do you need from your school administration to help you integrate game-based technology assessment tools?

Appendix D: Interview Question Protocol

Informed Consent Review

Research should only be done with those who freely volunteer, so everyone involved will respect your decision to join or not. You will be treated the same whether or not you join the study. If you decide to join the study now, you can still change your mind later. You may stop at any time. The researcher seeks 20 volunteers for the virtual interview. If you decide to join the study now, you can still change your mind later. You may stop at any time. Declining or stopping will not negatively impact the participant's relationship with the researcher or their workplace, as applicable.

Being in this study could involve some risk of minor discomforts that can be encountered in daily life, such as revealing things that are personal or recalling experiences that are uncomfortable. With the protections in place, this study would pose minimal risk to your well-being.

This study offers no direct benefits to individual volunteers. The benefit would be the identification of strategies that could be used to improve the utilization of technology among middle school teachers in the UAE.

This interview is planned to take between 20-30 minutes of your time. During the interview, I will be asking you a series of questions relating to your perspectives and strategies for using the game-based technology assessment tools of Alef, Kahoot, and Quizlet. If time runs short, I will ask your permission to either end the interview or to extend it for a few minutes. You can end the interview at any time.

Introduction to the Interview

Thank you for taking time to participate in an interview. You have indicated that you are willing to take part in a research study about teachers' firsthand experiences with digital assessment technology tools in their classrooms, and the strategies utilized to support positive teaching and learning with students. The title of the study is "Understanding Teachers' Use of Game-Based Technology Assessment Tools." This form is part of a process called "informed consent" to allow you to understand this study before deciding whether to take part. You must have at least one year of teaching experience using digital assessment tools to be able to participate in this study.

My name is Simone Saad, who is a doctoral student at Walden University, and will be conducting the interview. As a reminder, Zoom will be recording this interview.

Instructions: I will be asking questions regarding you experience with game-based technology assessment tools. Please share your honest perceptions and observations

pertaining to each of the questions. I may ask a follow-up question for clarification when needed. Thank you for your time and participation.

1. What is your opinion of using the game-based technology assessment tools of Alef, Kahoot, and Quizlet in your teaching?
2. How comfortable are you utilizing Alef game-based technology assessment tools with your students?
3. How comfortable are you utilizing Kahoot with your students?
4. How comfortable are you utilizing Quizlet with your students?
5. How do you include 1:1 technology with your students?
6. How are you implementing game-based technology assessment tools do you use in your remote teaching?
7. How are you implementing game-based technology assessment tools do you use in face-to-face teaching?
8. Please explain your opinion of Alef. What do you like and dislike about it?
9. Please explain your opinion of Kahoot. What do you like and dislike about it?
10. Please explain your opinion of Quizlet. What do you like and dislike about it?
11. What improvements or support to help you adopt more game-based technologies?
12. Is there anything else you would like to share regarding the use of game-based technology assessment tools?

Appendix E: Interview Question Alignment

Interview Questions	RQ1	RQ2
1. How many years of teaching experience do you have?		
2. How would you rate your technology skills?	X	
3. What are your opinions about using game-based technology assessments for teaching and learning?	X	
4. Explain how you use game-based technology assessment tools, such a Kahoot, Quizlet, and those in Alef, in your face-to-face classroom?	X	
5. Explain how you use game-based technology assessment tools, such a Kahoot, Quizlet, and those in Alef in your online or distance teaching?	X	X
6. Describe the culture surrounding game-based technology assessment tools at your current school - are they encouraged? Used effectively?		X
7. What are your experiences with the types of training provided by your school to learn about using technology-based games?		X
8. Please explain how you learned to use Kahoot, Quizlet, or Alef in your teaching.		X
9. Describe your preferred way to learn about game-based technology assessment tools.		X
10. What types of resources do you need to support adopting game-based technology assessment tools in your classroom?		X
11. What strategies can you provide for the best ways to implement game-based technology assessment tools?		X
12. What type of support do you need from your school administration to help you integrate game-based technology assessment tools?		X
13. Which game-based assessment tool among Kahoot, Quizlet, and Alef d you prefer and why?	X	
14. How can technology professional development workshops be improved to better support teachers' use of game-based tools?	X	

Appendix F: Data Coding Process

Open Codes	Axial Codes	Selective Codes
Effective learning practice Effective assessments Promotes Learning Instant Assessment Feedback Engagement Differentiated/Variety in Assessment Middle School Specific	Positive Use	Personal technological preferences
Kahoot Alef Quizlet Other	Preferred Tool	
Starter/Warm-up Activities Exit/Review Activities Measuring Lesson Objective/Learning Gaps Team-based learning Reinforcement/Informal Assessments Self-evaluation Homework Effective assessments Making Connections Engagement	Formative Assessments Summative Assessments	Technology as Assessment Aids
Variety of strategies Teacher modeling Peer to peer Practice/Preparation/Planning Training Games as Motivational Tools Exposure	Implementing Assessments	Technology as Assessment Aids
Self-study/Individual Assessments Summative Assessments Distance learning Face-to-Face Engagement Differentiation Reinforcement Activity/Review	Application of Tools	Current perceptions and Uses of Technology

Open Codes	Axial Codes	Selective Codes
Starter Activity/Warm-up		Current perceptions and Uses of Technology
Positive Availability of Technology Inconsistent Ineffective	School Culture	
Self-taught Peer-to-peer Effective PD Adequate Requested more training. Inadequate	Training Received	Technological knowledge acquisition
The school provided training. External training Self-taught Peer-taught Higher Education Courses	Learning Methods	
Access to technology (hardware) Access to technology (software) Administrative approval/support Training Time Motivation	Classroom Needs	Requirements for further use
Continued Professional Development/Training Analyzing Data Variety of resources Increased access Administrator Support IT Support/WIFI Access Time/Flexibility Tech Coach	Support Needed	

Open Codes	Axial Codes	Selective Codes
F2F PD Peer to Peer Self-taught School-Provided Training	Preferred Learning Methods	Effective technology based professional development
Dual-Perspective/Differentiation Continual Support Time/Reflection Purposeful Training Specificity Teacher-Led Workshops Training Options Time Feedback from Teachers Teacher Observations/Modeling Access	Improving PD	

Appendix G: Participant Responses

Themes	**Participant A**	**Participant B**	**Connecting RQ**
Personal technological preferences	"A wonderful and useful approach to the educational process, which makes learning fun and engaging for students."	"These are the best digital tools that allow learners to have fun while learning."	What are teachers' perceptions at Palm Tree Middle School, and Desert Sands Middle School rural middle schools in Abu Dhabi, about game-based technology assessment tools?
Technology as Assessment Aids	"We use them as feedback for block assessment and future planning. It aids with assessing gaps in learning, along with how to improve upon our own teaching."	"Kahoot can been used as a formative assessment since it informs me of the score of each individual student. I use this as an aid for the assessment for learning, in order to determine whether I have achieved my learning objectives. Also, it is an enjoyable tool to use for reviewing each students' score, during my lessons and before formal examinations."	
Current Perceptions and Uses of Technology	"Many teachers at my school utilize game-based technology assessment tools to keep students actively engaged. It is important to help students stay	"I could say that some of the teachers in each department used it effectively, while other teachers in other departments didn't use any game-based technology	How are teachers at Palm Tree Middle School, and Desert Sands Middle School rural middle schools in Abu Dhabi,

Themes	Participant A	Participant B	Connecting RQ
	motivated, in order for them to pace and monitor their own progress."	assessment tools in their classes."	implementing game-based technology assessment tools during remote and face-to-face teaching?
Technological knowledge acquisition	"I have never received any training from any organization on how to utilize technology-based games in my classrooms. It has always been a teacher-led initiative where I self-taught or learned from my teaching peers."	"There was never enough training around technology-based games. I coincidentally learned about it from other teachers."	
Requirements for further use	"We need an approval from management to bring our own devices, in addition to more funding for any technology related fees, such as a strong network connection. As well, we would need time for trial-and-error periods with our students. Also, it would be beneficial if management could embrace technology-based learning and is not hesitant to incorporate new programs.	"I need consistent professional development sessions that's related to how to analyze reports gathered from assessments, as well as how to incorporate the technology as a form of differentiation, so that I can better adapt my assessments."	
Effective technology based professional development	"PD timings and sessions must be well thought out. Preferably, they should not take place after a	"I would recommend PD sessions about the different points of views of the educator and student	

Themes	Participant A	Participant B	Connecting RQ
	long day of teaching, as the teacher might feel exhausted.	on these digital tools. As a result, teachers would gain a stronger understanding of how both points of views might appear. While using these digital tools, I think there should be a follow-up session, immediately after a PD session is given, in order to allow room for reflection.”	

Appendix H: Professional Development Schedule

Module 1	**Hours**	**Module**	**Weeks**
Introduction YouTube Video (Alef) + YouTube Video (teacher-made)	0.5	Alef	1
Discussion List two ways you could use Alef in your classroom; one critique of the program and one hesitation you have. Then, reply to two group members' critiques/hesitations making one suggestion and asking two further questions.	1	Alef	2
Task Allocate Alef Learning Task to students and consult the data.	2	Alef	3
Discussion Evaluate the experience of using Alef as a formative assessment tool over traditional means.	1	Alef	3
Reflection Questionnaire Discuss personal takeaways from the module.	0.5	Alef	4

Module 2	**Hours**	**Module**	**Weeks**
Introduction YouTube Video (Kahoot) + YouTube Video (teacher-made)	0.5	Kahoot	5
Discussion List two ways you could use Kahoot in your classroom; one critique of the program and one hesitation you have. Then, reply to two group members' critiques/hesitations making one suggestion and asking two further questions.	1	Kahoot	5
Task Construct a review quiz of previously taught material using Kahoot	2	Kahoot	6

Module 2	**Hours**	**Module**	**Weeks**
Discussion Explain the impact of using Kahoot as a review tool on teacher workload and student engagement over traditional means.	1	Kahoot	7
Reflection Questionnaire Discuss personal takeaways from the module.	0.5	Kahoot	8

Module 3	**Hours**	**Module**	**Weeks**
Introduction YouTube Video (Quizlet) + YouTube Video (teacher-made)	0.5	Quizlet	9
Discussion List two ways you could use Quizlet in your classroom; one critique of the program and one hesitation you have. Then, reply to two group members' critiques/hesitations making one suggestion and asking two further questions.	1	Quizlet	9
Task Create Quizlet activity to introduce a new topic and assess students' prior knowledge.	2	Quizlet	10
Discussion Compare the impact of using Quizlet to activate schemata on teacher workload and student engagement over traditional means.	1	Quizlet	11
Reflection Questionnaire Discuss personal takeaways from the module.	0.5	Quizlet	12