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Pursuing Perceptions: Exploring Ease of Use, Usefulness, Relevance, Self-Efficacy, and Past Experiences to Describe Influences on Elementary Teachers' Acceptance of Digital Game-Based Materials

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PURSUING PERCEPTIONS: EXPLORING EASE OF USE, USEFULNESS, RELEVANCE, SELF-EFFICACY, AND PAST EXPERIENCES TO DESCRIBE INFLUENCES ON ELEMENTARY TEACHERS' ACCEPTANCE OF DIGITAL GAME-BASED MATERIALS

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DEDICATION

I would like to dedicate this dissertation to my family for their never-ending support and understanding. First, this dissertation is dedicated to my wife Suzanne. Her love, encouragement, and understanding were a constant guiding light of hope. She was supportive through the difficult times, and she always believed in me. I love and admire her for the kindness and respect she shows towards others. Suzanne means everything to me, and I could not have done this without her.

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ABSTRACT

There are many acceptance factors that might influence teachers' intent to create instruction supplemented or enhanced with digital game-based materials (DGBM). A mixed-methods exploration of five research questions was used to describe how teachers' perceived ease of use, self-efficacy beliefs, opinions about usefulness, perceptions of relevance, and past experiences informed their acceptance of digital game-based materials. This research study took place at Hill Street Elementary School, which is a suburban K-5 school within the Kaia County School District. Data collection was conducted using a survey, one-on-one interviews, and fieldnotes. A purposeful sample of nine interview participants from grades K-4, and 18 survey participants from grades K-5 was used. Teachers' high agreement with statements of perceived self-efficacy and perceived ease of use were shown to be the most influential on DGBM acceptance. Perceived usefulness and perceived relevance were shown to moderately influence acceptance. Experience was the least influential construct tested in the study. Qualitative analysis identified three themes: (1) self-efficacy and issues with use influenced teachers' views about DGBM; (2) effort and engagement influenced the use of adaptive learning games; and (3) independent learning opportunities and curriculum connections influenced acceptance of DGBM. Adaptive learning games made DGBM easier to use, but student technology proficiency decreased ease of use. Self-efficacy influenced teacher acceptance of DGBM but was mediated by teacher beliefs about how to implement DGBM and teaching students how to play the game. Perceived usefulness was controlled by

motivation and engagement. Perceived relevance was affected by limitations of curricular connections in DGBM. Digital game-based learning experiences teachers allowed for their students influenced acceptance of DGBM more than teachers' personal gaming experience. Future professional development for K-5 teachers is recommended. Improving teachers' technological and pedagogical content knowledge of digital games (TPACK-G) could improve the use of DGBM and the constructs that influence acceptance. Also, by extending the results of the current study on a larger scale using an experimental design, future researchers may be able to examine the effects of professional development on improving elementary teachers' perceptions of and experiences with DGBM.

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CHAPTER 1: INTRODUCTION

National Context

Technology integration in education is a complicated process that does not depend solely on technology related factors. True technology integration considers teachers' acceptance as well as availability and access of technology resources. Teachers' pedagogical beliefs and acceptance of technology play important roles in the adoption of educational technologies. Interest in educational video games and digital game-based materials (DGBM) is on the rise and many teachers express an interest in using digital games for instructional purposes (Sanchez, Kim, & Weisburgh, 2016). The culture around digital games has steadily increased, as well as the average age of the gamer (New Media Consortium, 2014). Children are not the only ones playing digital games. Teacher interest in playing digital games at home has increased the use of digital games in classrooms (McNulty, Shulman, & Jorgensen, n.d.). Students are becoming extremely adept at gaming. However, schools today may not parallel the preferred learning styles of students. This begs the questions: Are teachers keeping up with their students' interests in digital gaming? Are teachers accepting the increased interest to use digital game-based educational materials?

Ample research describes the positive effects of using digital games in the classroom, while numerous other studies have identified barriers preventing and factors influencing teachers' use of DGBM in the classroom. In 2013 the Joan Ganz Cooney Center, on behalf of the Games and Learning Publishing Council, conducted a national

survey of 694 K-8 teachers to find out more about their use of digital games with their students. According to this survey, 82% of teachers stated that they play video/digital games for entertainment or other non-work/non-professional related reasons, and 78% of those teachers say that they use games in their teaching (Takeuchi & Vaala, 2014). Seventy-four percent of teachers polled reported that they regularly use games to teach core and supplemental content, assess students, and expose students to a wider range of digital tools (Takeuchi & Vaala, 2014). Over half of those teachers (55%) also reported using digital games at least once weekly in their teaching, while 26% reported never using digital games (Takeuchi & Vaala, 2014). Other surveys have found that over half of teachers polled used games at least weekly in their instruction (Fishman, Snider, Riconscente, & Tsai, 2014; McNulty et al., n.d.).

There is a relationship between students' motivational levels and cognitive processing in game-based learning environments (Huang, 2011). In a 2013 study by the American Psychological Association, researchers emphasized the cognitive, motivational, emotional, and social impact of digital games (Granic, Lobel, & Engels, 2013). Takeuchi and Vaala (2014) found that 60% of teachers reported seeing an increase in attention to tasks and improved collaboration with their classmates after integrating digital games into their instruction. Other studies have shown that teachers who use digital games in their classroom reported increases in student engagement (Hamari et al., 2016; McNulty et al., n.d.), enjoyment (Barzilai & Blau, 2014), motivation (All, Castellar, & VanLooy, 2015; Huang, 2011; Tsai, Yu, & Hsiao, 2012; Sung, Hwang, Lin, & Hong, 2017), and learning (Granic et al., 2013; Takeuchi & Vaala, 2014; Vogel et al., 2006).

Issues such as teachers' pedagogical beliefs and digital game-based learning pedagogy greatly influence how often teachers use technology in the classroom (Dolan, 2016; Kangas, Koskinen, & Krokfors, 2017; Nousiainen, Kangas, Rikala, & Vesisenaho, 2018). Effective teacher training and professional development has been found to improve authentic integration of DGBM (Ketelhut & Schifter, 2011; McManis & Gunnewig, 2012; Ucus, 2015). However, many in-service teachers report learning to teach with digital games by asking colleagues or by teaching themselves how to use them, and therefore are not gaining deeper pedagogical strategies and a wider range of resources (Takeuchi & Vaala, 2014). In 2014, Takeuchi and Vaala reported that only 8% of K-8 teachers said they had ever received pre-service training on digital game integration, 33% first learned about using games from another educator, and 68% stated they would prefer to go to other teachers within their school or district for assistance with using digital games in the classroom.

Studies have shown that acceptance of digital games in education can be influenced by many factors. Teachers' perceptions, experience, and curriculum-relatedness greatly affected their acceptance of digital games in education (De Grove, Bourgonjon, & Van Looy, 2012; Domingo & Gargante, 2016). Also, many teachers believed there were several internal challenges affecting their decisions to integrate digital games in the classroom (Wu, H., 2015). Preservice teachers' readiness and attitude levels have been found to positively affect their acceptance of certain technologies (Tezer & Beyoğlu, 2018). According to a survey of 116 pre-service and in-service teachers, more than half of the respondents expressed that "lack of knowledge and skills in teaching strategies, outcome assessment, and making justifiable choices of digital tools to

match subject area matters" were internal challenges that affected their decisions to integrate digital games in the classroom (Wu, H., 2015, p. 129).

Local Context

DGBM are often used to enhance classroom instruction, and studies have identified barriers preventing and factors influencing teachers' acceptance of DGBM in the classroom. This leads to wondering what informs a teacher's decision to accept digital games as important educational resources at the local level. The name of the school, district, and state where this study was conducted are pseudonyms and all relevant citations have been removed to protect participants' identities. According to the *Wisconsin State Educational Technology Plan*, "there is evidence across the state that students desire the use of technology and have the ability to adopt it successfully when properly instructed". The Wisconsin Department of Education states that "the rollout and support models associated with classroom technology directly impact the teacher's ability to learn the product, use the product, educate their students using the product and achieve success in the classroom". Many school districts across Wisconsin struggle to provide adequate training and support services to teachers because of operating in a reactionary mode, not proactively analyzing new technologies, rushing the rollout of new technologies, and trying to provide training to teachers while dealing with state budget cuts that have reduced the number of technology training and support services. This suggests that for Wisconsin students to truly be successful in using educational digital games, Wisconsin school districts must prepare their teachers to use DGBM, provide opportunities to increase their experience using DGBM, understand the proper pedagogical strategies needed to integrate them, and teach their students how to use them.

This research study took place at Hill Street Elementary School (HSES) within the Kaia County School District (KCSD), which is one of 4 public school districts in Kaia County, Wisconsin. Its teacher technology proficiency requirements focus on three components: completing a KCSD Technology Needs Assessment; maintaining a classroom webpage; and participating in at least three hours of technology-based professional development every year. Teachers have a variety of choices that qualify as technology-based professional development. These opportunities include participating in courses designed and taught by the KCSD Technology Integration Team, completing district-created professional development, participating in SimpleK12 webinars with an instructional technology focus, attending conferences that focus on technology integration, and enrolling in technology-based college courses. Though the use of a bi-weekly newsletter, new technology materials are being promoted by the KCSD Technology Integration Team. However, professional development on using DGBM and understanding the proper pedagogical strategies needed to integrate them is not being produced or promoted.

Statement of the Problem

Although ample research has been written about teachers' acceptance of digital games in education, as well as the effectiveness of these technologies, there is a need to describe how perceptions and experiences inform elementary teachers' acceptance at the local level. Through conversations with elementary teachers in KCSD, it is known that technologies are available if they want to use digital-game based resources. However, teachers' current acceptance of these resources as practical and useful materials that can supplement or enhance their instruction is unknown. There could be many factors that

influence teachers' decisions to accept, adopt, and use digital games. Since the school improvement plans of each elementary school in KCSD are revised every year, there is a need for research regarding teachers' current acceptance of technologies such as digital game-based resources. HSES teachers can create lessons supplemented and enhanced with digital game-based and/or gamified materials but examining factors that inform HSES teachers' acceptance of DGBM has never occurred. Understanding the current conditions related to teacher acceptance of DGBM can lead to recommendations to increase or decrease the resources used to plan, implement, and support the use of DGBM. An in-depth study of the perceptions and experiences that inform acceptance may enable elementary schools to revise their school improvement plan, better define the educational technologies it wishes to promote, and provide professional learning opportunities that are informed by teachers' perceptions.

Purpose Statement

The purpose of this research study was to explore ease of use, usefulness, relevance, self-efficacy, and past experiences to describe influences on elementary teachers' acceptance of digital game-based materials.

Research Questions

RQ1: How, and to what extent, does ease of use influence teacher acceptance of digital game-based educational materials?

RQ2: How, and to what extent, does self-efficacy influence teacher acceptance of digital game-based educational materials?

RQ3: How, and to what extent, does usefulness influence teacher acceptance of digital game-based educational materials?

RQ4: How, and to what extent, does relevance influence teacher acceptance of digital game-based educational materials?

RQ5: How, and to what extent, does experience influence teacher acceptance of digital game-based educational materials?

Statement of Research Subjectivities and Positionality

I love the old saying, "Give a man a fish and you feed him for a day; teach a man to fish and you feed him for a lifetime" (Maimonides Quotes, n.d.). It is the core of what I believe to be the goal of education. It is also why I decided to pursue a graduate degree in educational technology. I want to help others use technological resources better, but not just by presenting the next best app, the newest website, what's hot, or what's trending. By understanding how learning theories and educational psychology have influenced educational technology, I can help teachers have the level of knowledge they need to be self-reliant in their search for educational technology resources.

Helping others better use technological resources begins with increasing my own content knowledge and pedagogical skills related to educational technology. My main research interest is describing teachers' current perspectives regarding factors that may influence their decisions to use or not use DGBM for instructional purposes. However, I am also interested in learning theories and understanding how educational psychology has impacted educational technology. My interests in behaviorism, cognitivism, and constructivism have led me to want to learn more about educational technology integration models, such as the Substitution Augmentation Modification Redefinition (SAMR) model, the Technology Acceptance Model (TAM), or the Technological

Pedagogical and Content Knowledge (TPACK) model, and how those models may impact teachers' use of digital games.

I first learned about paradigms and paradigm shifts a few years ago from the work of Dr. Stephen Covey. He described a paradigm as how we see the world, which influences our behaviors and habits, which then influences what we get (Covey, 2008). Covey discussed the importance of experiencing a paradigm shift when trying to truly understand someone. Having a paradigm shift takes time, though. It is not simply seeing a situation from a different perspective. Paradigms, or mindsets, are often so deeply rooted that they cannot easily be changed and instead one should recognize that there are discourses expressed through the words we use and the way we use language (Kinash, 2006). A pragmatic paradigm aligns well with my research interests. Pragmatism finds useful connections with new knowledge, and it regards common sense and practical thinking as important (Grant, 2016). Pragmatists do not commit to any specific philosophical system in order to provide the best understanding of the current problem (Creswell & Creswell, 2018). Epistemology in pragmatism guides the researcher through problem solving methods because, according to Morgan (2014), "the origins of our beliefs arise from our prior actions and the outcomes of our actions are found in our beliefs" (p. 1,046).

My positionality within my research is that I am a teacher, and my study participants were teachers. A researcher working with colleagues can contribute to the existing knowledge base, improve colleagues' professional practice, and transform the educational technology profession, however he must take caution to not place himself in a position of power where the results of research may benefit the researcher at the cost of

the participants (Herr & Anderson, 2005). My positionality within the study meant that I remained ethical and unbiased while collecting and analyzing the data. Following the recommendations of Mason (2002), I have considered my standards of what is ethical and recognize that these standards may stem from sources that are unlikely to be neutral, such as my own experiences and values.

Other ethical issues can arise as a result of positionality, such as pressuring participants to sign consent forms, respecting the research site, and disrupting schedules (Creswell, 2014). Undue influence and conflict of interest are ethical considerations because I currently work at the research site and have worked there since 2014. Since the research site is my current place of employment, there were issues related to data collection methods that needed to be considered. All necessary permissions from the school principal and/or district officials were obtained (Appendix E), and all consent forms (Appendix A) were collected from participants prior to beginning the study. Because the participants were known to me, anonymity was impossible, but was important to provide participants with a high level of confidentiality (Lune & Berg, 2017). The informed consent form discussed key information about the research study, identify potential risks, and specified how I planned to manage those risks. Following the advice of Lune and Berg (2017), the form did not overshare details of the study, such as revealing or explaining too much information that would invalidate the research.

Definition of Terms

Digital game-based materials – Any learning game on a computer or online (Prensky, 2001).

Experience – The exercises and games used to involve students in the learning process (Kolb & Kolb, 2009).

Gamification – Gamification involves using game-based processes and principles to increase engagement, motivation, and learning (Kapp, 2012).

Perceived ease of use – Perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320).

Perceived usefulness – Perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989, p. 320).

Relevance – Relevance is defined as "an individual's perception regarding the degree to which the target system is applicable to his or her job" (Venkatesh & Davis, 2000, p. 191).

Self-efficacy – Self-efficacy is defined as "an individuals' control beliefs regarding his or her personal ability to use a system" (Venkatesh & Bala, 2008, p. 278).

Technology Acceptance – Technology acceptance is defined as "a user's willingness to employ technology for the tasks it is designed to support" (Teo, 2011, p.1).

CHAPTER 2: LITERATURE REVIEW

This analysis of literature related to teachers' acceptance of digital game-based materials (DGBM) focuses on the following research questions: 1) How, and to what extent, does ease of use influence teacher acceptance of digital game-based educational materials; 2) How, and to what extent, does self-efficacy influence teacher acceptance of digital game-based educational materials?; 3) How, and to what extent, does usefulness influence teacher acceptance of digital game-based educational materials?; 4) How, and to what extent, does relevance influence teacher acceptance of digital game-based educational materials?; and (5) How, and to what extent, does experience influence teacher acceptance of digital game-based educational materials?

Several main variables were derived from the research purpose, including *digital game-based learning*, *DGBL*, *digital game*, *gamification*, *video game,* and *serious game*. Using these variables as keywords with different combinations of additional keywords such as *perception, acceptance, adopt,* and *intent* guided me in my search through a variety of electronic databases. I primarily used Find It @ University of Wisconsin Libraries in my search for relevant literature. Using multiple keyword searches in multiple online databases enabled me to find relevant research to back my goals. Additionally, mining the references of several key studies enabled me to find pertinent research that did not come to light in my previous searches. Research question constructs provided additional search parameters using keywords such as *effective, use, experience,*

attitude, usefulness, and *ease of use*. Other databases, including JSTOR, ProQuest, and Google Scholar were occasionally used in the search for literature related to my study.

Six major sections of literature review are used to develop an understanding of the current state of knowledge surrounding acceptance of DGBM. These six sections direct the review of literature and provide purpose and justification for the research design. In the first section, digital game-based materials are explained using relevant definitions of game, gamification, and digital game-based learning (DGBL). Section two describes theoretical approaches used in past research to investigate the use of digital games in educational settings. In section three, the development and application of several models used to describe technology acceptance is discussed. The fourth section calls attention to literature that highlights what is known about teachers' acceptance of digital game-based educational materials, followed by a discussion of challenges and issues related to use. Section five describes the conceptual framework used in this study. The pertinent factors found to influence technology acceptance is discussed, including perceived usefulness, perceived ease of use, relevance, self-efficacy, and past experiences. The sections that follow detail the relevant literature on (a) digital game-based educational materials, (b) what is known about effectiveness of digital game-based educational materials, (c) what is known about the influence of constructivism, (d) addressing technology acceptance, (e) what is known about teachers' acceptance, and (f) the development of the conceptual framework for the current study.

Digital Game-Based Educational Materials

Digital game-based and gamified learning materials can be used in KCSD classrooms to supplement or enhance teachers' lessons. The goal of this section is to

distinguish digital game-based educational materials by discussing relevant and sometimes intersecting concepts such as (a) game-based learning, (b) gamification, and (c) digital game-based learning.

Game-Based Learning

Games have been around for a long time and many people have postulated their definition of the term game. Kapp (2012) defines *game* as "a system in which players engage in an abstract challenge, defined by rules, interactivity, and feedback, that results in a quantifiable outcome often eliciting an emotional reaction" (p. 32). For many years, educators have used the immersive qualities of games to facilitate higher levels of engagement in the classroom. Game-based learning (GBL) systems have improved learning outcomes because games construct links between knowledge and social skills, thus supporting permanent learning (Ucus, 2015). Researchers have found that GBL is an effective means of posing learning challenges that are perceived as interesting and enjoyable, resulting in engagement and immersion in the game-based learning task (Hamari et al., 2016). However, others have revealed that elementary school teachers have developed different understandings for GBL, perhaps because of lack of teachers' knowledge and experiences on GBL's scope and its principles (Ucus, 2015).

Gamification

Often, instead of using an actual game (e.g., card game, board game), teachers will turn some aspect of a lesson, an entire lesson, or some other activity in the classroom into a game using gamification. Kapp (2012) defines gamification as "using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems" (p. 34). Experiments evaluating gamification elements and

gamification effectiveness have led researchers to suggest that effective gamification should include rewards (trophies and badges) and competitive features (points and leaderboards) (Hamari, Koivisto, & Sarsa, 2014; Rabah, Cassidy, & Beauchemin, 2017). Gamification can be effective for increasing engagement (Kuo & Chuang, 2016) and can improve students' feelings of competence and task meaningfulness (Sailer, Hense, Mayr, & Mandl, 2017). Gamification can also effectively improve learning outcomes (Clark, Tanner-Smith, & Killingsworth, 2016). Gamification can have negative consequences, though, if not used properly. Hanus & Fox (2015) found that gamified elements which evoke competition caused a decrease in motivation, satisfaction, and learning outcomes. However, a limitation to their study was that certain gamified activities, such as earning badges, were posed as mandatory. They further posited that gamification may be more effective when students have the option to earn badges.

Digital Game-Based Learning

Digital game-based learning (DGBL) considers elements of GBL and gamification and combines that with the immersive power of digital games. Digital games are iPad apps, computer games, and Internet websites that align with constructs found in many definitions of the word *game*. DGBL will contain many of the same constructs of GBL, such as rules, goals, challenges, problem solving, interactivity, and feedback that lead to a quantifiable outcome (Alzubi, Fernandez, Flores, Duran, & Cotos, 2018). Prensky (2001) generally defined DGBL as any learning activity using digital games. Other researchers have defined DGBL as "the usage of the entertaining power of digital games to serve an educational purpose" (All, Castellar, & Van Looy, 2016, p. 91). Using digital games in education has its benefits. They allow students to solve

challenges, have early successes when skills are low, and earn rewards that provide motivation and incentive as knowledge and expertise increases (Van Eck, 2015).

The Effectiveness of Educational Games

The importance of using digital games in education has been illustrated by past research. Studies on the measurement of effectiveness have varied from motivation and engagement-related psychological outcomes to use behavior-related outcomes, and have generated both positive and negative results (Hamari et al., 2014). Learning effectiveness has been described as an increased interest, achievement of learning goals, and transfer (All et al., 2015). DGBL activities have been found to foster higher-order thinking more than factual or verbal knowledge acquisition (Domínguez, Saenz-de-navarrete, Fernández-sanz, & Pagés, 2013; Ke, 2009). Researchers have shown that improvements in engagement and flow experiences in game-based learning can increase levels of concentration, interest, and enjoyment (Chang, Liang, Chou, & Lin, 2017; Hamari et al., 2016; Seixas, Sandro, & Jos, 2016). Researchers also found that when compared to traditional instruction, the use of augmented reality games can greatly improve the interest level of students and help them attain the concepts the game intended to develop (Leitao, Rodrigues, & Marcos, 2014). Interest and engagement in games have had positive effects on learning outcomes when students possess the motivation to learn new knowledge in the game (Hamari et al., 2016; Tsai et al., 2012). Other researchers have found that using video games aligned to curriculum fosters students' self-efficacy because video games provide feedback to players about their actions, thereby focusing on the positive aspects of the player's performance (Nino & Evans, 2015).

Some research suggests that educators may not perceive digital-game based educational materials as effective instructional tools because few studies have reported the effect of games on the development of 21st century skills (Qian & Clark, 2016) or directly measured metacognitive processes (Ke, 2009). In 2012, Hwang and Wu reviewed 137 DGBL articles published from 2001-2010 and concluded that most studies focused on the investigation of students' motivations, perceptions, and attitudes toward digital games. Although most researchers attribute DGBL to increased learning outcomes, few previous studies on DGBL effectiveness were based on learning theories (Wu, H., Hsiao, Wu, Lin, & Huang, 2012; Wu, W., Chiou, Kao, Hu, & Huang, 2012). DGBL research shows that it has value in education, but research on perceptions and attitudes leads to further questions about teachers' accepting digital game-based educational materials.

The Influence of Constructivism

Constructivist learning theory has grounded numerous digital game-based education studies in the past. A review of the literature shows that many studies applied constructivist learning theory to the design, development, and implementation of educational video games and DGBL. This section will highlight how digital game-based materials can improve learning in a constructivist learning environment.

The constructivist approach to learning emphasizes the role of the student in making sense of the learning, building knowledge based on the learning experience, and reflecting on that experience (Ertmer & Newby, 2013; Harasim, 2012). Constructivist learning theories have influenced DGBL by contending that the learner's abilities and skills are important and that games need to be adaptive to the needs of the learner (Vasalou, Khaled, Holmes, & Gooch, 2017). An authentic constructivist learning

environment must provide the students with an opportunity to make meaningful connections between the task and the real world. The environment must be carefully designed with appropriate opportunities for students to construct their knowledge during a particular task (Zualkernan, 2006). In a digital game-based learning environment influenced by constructivism, learning activities provide authentic settings, support cooperative construction of knowledge, encourage reflection, include scaffolding by the teacher, and provide for authentic assessment of learning within the game (Zualkernan, 2006).

Constructivists endorse the teacher's role as that of a facilitator, understanding that his/her students have contributions to the learning experience that help him/her construct knowledge within the game (Altuna & Lareki, 2015; Ertmer & Newby, 2013; Harasim, 2012). The teacher has the responsibility of creating an environment that promotes authentic tasks that provide students multiple ways of connecting the new learning, interacting with peers, and searching for meaning, while at the same time understanding that his/her students have contributions to the learning experience that can only be realized by questioning their thinking and listening to their responses (Applefield et al., 2001). Constructivist learning design in DGBL supports the importance of knowing what instructions and feedback students need to discover within the game and follow-up learning activities (Wiburg, Parra, Mucundanyi, Latorre, & Torres, 2017).

Understanding the constructivist learning design in DGBL may help teachers accept more digital game-based experiences for their students. Because there is a relationship between the learning theories and the technological resources a school uses, teacher training should combine learning theories and educational technology (Altuna &

Lareki, 2015). More research is needed in the use of DGBL and in the development of DGBL pedagogy so that DGBL becomes more inclusive and meaningful for young children (Nolan & Mcbride, 2014). Further action is needed to prepare teachers on how to apply constructivism in the development of DGBL activities that promote social context, interaction, and authentic tasks.

Addressing Technology Acceptance

The following review of literature highlights empirical studies that have successfully tested constructs found to influence technology acceptance. In doing so, researchers have developed and improved three Technology Acceptance Models (TAMs) and the Unified Theory of Acceptance and Use of Technology (UTAUT). This section will describe (a) the TAMs, (b) the UTAUT, (c) critical research about TAM factors and limitations, and then conclude by discussing (d) the use of extended variables to overcome TAM's limitations.

Technology Acceptance Models

In 1989, Fred Davis created the Technology Acceptance Model (TAM), which theorizes that a person's behavioral intention to use a technological system is influenced by perceived usefulness (PU) and perceived ease of use (PEU), and those perceptions can be affected by external factors such as beliefs (Davis, 1989). To develop the TAM, Davis began by using conceptual definitions of perceived usefulness and perceived ease of use rooted in several theoretical foundations (e.g., efficacy theory, behavioral decision theory, adoption of innovations theory) to create a 14-item questionnaire. He subjected this questionnaire to a pretest and two rounds of field testing to refine and validate the antecedent scales. From the results of his research, Davis concluded that perceived ease

of use and perceived usefulness positively influence behavioral intent to use a technology. In addition, Davis found that perceived ease of use precedes perceived usefulness. Individuals accept systems according to their beliefs about its usefulness, which is influenced by their beliefs about the systems' ease of use. If the users do not believe a system to be useful, then they are unlikely to use it.

In 2000, Venkatesh expanded Davis' research. He proposed a theoretical framework to explain determinants of perceived ease of use. Specifically, he empirically tested the effects of anchor (control, intrinsic motivation, and emotion) and adjustment (perceived enjoyment and objective usability) constructs on perceived ease of use. In addition, Venkatesh proposed that experience will have a moderating effect on those variables over time. Venkatesh also hypothesized that influences on behavioral intent to use a system will change from general to more system-specific perceptions and expectations. Three longitudinal field tests were conducted, and the results of the study indicated that with increasing experience over time, both adjustment and anchor variables of control (computer self-efficacy and facilitating conditions), intrinsic motivation (computer playfulness), emotion (computer anxiety), were found to influence perceived ease of use. Computer self-efficacy and external conditions (system-specific supports) were stronger determinants than adjustment constructs resulting from experience.

Later that same year, Venkatesh and Davis (2000) conducted four longitudinal field studies in order to extend TAM by including key factors of perceived usefulness and additional constructs related to use. Theoretical constructs for the study were operationalized using validated instruments from previous research. These constructs were used to create a survey administered to participants in each field study three

subsequent times (pre-implementation of the system, one-month post-implementation, and three-month post-implementation). By including social influence processes (subjective norm, voluntariness, and image) and cognitive instrumental processes (job relevance, output quality, result demonstrability, and perceived ease of use), TAM 2 provided a thorough explanation of key determinants of perceived usefulness and usage intention, explaining up to 60% of the variance (Venkatesh & Davis, 2000).

In 2003, researchers integrated eight technology acceptance models and theories to create a single unified theoretical model called the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, Smith, Morris, Davis, & Davis, 2003). To test this new model, the researchers created a questionnaire that contained items measuring constructs from all eight theoretical models and theories, then administered that questionnaire in longitudinal field studies at four locations and at three different points in time (after training, one month after implementation, and three months after implementation). The researchers conclude that performance expectancy, effort expectancy, and social influence are direct determinants of an individual's intent to use a technological system; intention and facilitating conditions are direct determinants of usage behavior; and significant moderating influences of experience, voluntariness, gender, and age are important features of UTAUT (Venkatesh et al., 2003).

In 2008, Venkatesh and Bala hypothesized that experience and voluntariness can act as modifiers of behavioral intention. To test this theory, they created the TAM3 survey, which includes anchor variables (Computer Self-Efficacy, Perceptions of External Control, Computer Anxiety, Computer Playfulness) and adjustment variables (Perceived Enjoyment and Objective Usability). Four longitudinal field tests were

conducted to test TAM3. TAM3 improved TAM2 by explaining that experience weakened the effect of perceived ease of use on perceived usefulness and that factors such as computer self-efficacy and computer anxiety had less effect on perceived usefulness than other known determinants. (Venkatesh & Bala, 2008).

Criticism

Research critical of TAM's effectiveness on adoption determinants has pointed to several key factors. In 2007, Bagozzi described five shortcomings of TAM:

> (1) two critical gaps in the framework, (2) the absence of a sound theory and method for identifying the determinants of PU and PEU, as well as other bases for decision making, (3) the neglect of group, social, and cultural aspects of decision making, (4) the reliance on naïve and over-simplified notions of affect or emotions, and finally (5) the over dependence on a purely deterministic framework without consideration of self-regulation processes. (p. 245)

If researchers use TAM to study technology usage intent, then Bagozzi's suggestions highlight the importance of including factors that determine PU and PEU, as well as making sure not to neglect the important role social influences and self-efficacy plays in determining acceptance and use.

Some research findings have pointed out the importance of considering the role of contextual variables on behavior intention, unlike the TAM which posited that contextual variables only influenced behavior indirectly (McFarland & Hamilton, 2006). Moreover, a meta-analysis of 114 empirical TAM studies tested the suitability of the TAM (and its editions) and found that the TAM explains technology acceptance well but "the role of certain key constructs and the importance of external variables contrast some existing beliefs about the TAM" (Scherer, Siddiq, & Tondeur, 2018, p. 13). While past research clearly demonstrated successful TAM application in various technological systems acceptance, critical research about TAM factors and limitations in technology acceptance

needs consideration before it is applied to digital-game research. De Grove et al. (2012) pointed out that the TAM needed more antecedents of ease of use and usefulness to improve its ability to describe digital game acceptance. Those researchers admitted a key limitation to their study was that the use of digital games in education was new, and most teachers had yet to develop beliefs and attitudes about using them. However, their study was in 2012 and the age of the research casts doubts on their conclusion's impact in more recent times. It is possible that teachers have since developed considerable perceptions towards accepting digital games and DGBM.

Overcoming TAM's Limitations

Researchers have shown ways of overcoming TAM's limitations through experiments with extended variables and in different contexts. According to He, Chen, and Kitkuakul (2018), past researchers have extended the TAM by identifying additional and independent constructs of adoption, examining antecedents to PEU and PU, and by identifying factors that restrain the influence of perceived ease of use and perceived usefulness. When examining higher education instructors' intention to use educational video games, Sánchez-Mena, Martí-Parreño, and Miquel-Romero (2019) incorporated variables of attention and relevance from Keller's ARCS model to overcome TAM limitations to explain adoption intentions. In a systematic review and synthesis of 87 research articles on TAM in mobile learning from 2006 to 2018, the researchers found that 55% of studies extended the TAM by other variables and that 22% of those articles extended the TAM by factors from other models (Al-emran, Mezhuyev, & Kamaludin, 2018).

Since its origination, TAM has been successfully applied to different contexts. In 2015, Cheon, Chung, and Lee found that perceived enjoyment and perceived usefulness, along with game scores, positively influenced satisfaction and behavioral intention, while game expertise significantly affected perceived usefulness. When investigating elementary school students' technology acceptance of DGBL applied to environmental education, Cheng, Lou, Kuo, and Shih (2013) determined that students' perceived ease of use, perceived usefulness, attitudes toward use, and intention to use revealed positive and significant correlations. The TAM has also been used to investigate the acceptance of DGBL among undergraduate students at a Malaysian university (Idris, Sin, & Ya'u, 2015) and to validate several attributes used in the design and development of a serious game (Yusoff, Crowder, & Gilbert, 2010).

These results open the door to more research that shows effective use of TAM variations. To see whether these findings apply to K-5 teachers' acceptance of digital game-based materials, this study used a conceptual model based on TAM editions to describe how, and to what extent, certain factors contribute to HSES teachers' acceptance of DGBM. Criticism of the TAM, along with research on TAM experiments with revised variables, informed the current study's use of the conceptual model.

Teachers' Acceptance of Digital Games

Educators put value in technologies that can offer them resources for students' learning and assessment. This value is greatly influenced by educators' attitudes towards accepting a technological resource as a viable educational material that will be effective in the classroom. Therefore, it is important to examine literature that highlights what is

known about teachers' acceptance of digital game-based educational materials, as well as discuss the challenges and issues related to use.

Engagement, effectiveness, and alignment to learning standards are considered important matters in teachers' decision to use educational digital games (Sanchez et al., 2016). Educators have perceived a significantly higher level of learning and they believe that increasing student engagement is a strong factor that determines the use of gaming apps in the classroom (Domingo & Gargante, 2016). Teachers believe that games can construct links between education and social life and support permanent learning because students enjoy being active in the game (Ucus, 2015). Teachers also report that digital games improve student engagement, motivation, and the teaching or reinforcing of concepts (Sanchez et al., 2016; Takeuchi & Vaala, 2014).

Past research studies have also discussed the challenges and issues related to using digital game-based educational materials. One comprehensive literature review on teachers' acceptance of educational video games found a variety of barriers that influenced teachers' acceptance of digital games, including technical and organizational support, training, and previous gaming experience (Sánchez-Mena & Martí-Parreño, 2017). Teachers felt that outcome assessment and making justifiable choices of digital tools to match subject areas are challenges to the use of digital games in education (Wu, H., 2015). One possible explanation for these findings is that there is a lack of professional development in DGBL. An alternative explanation is that teachers do not perceive digital games as instructional tools. Past research leads to question how teachers' perceptions about the use of digital game-based activities influences their decisions to accept them as educational materials.

Development of a Conceptual Model

The current study used a conceptual framework created for the purpose of collecting data to describe how perceptions and experiences inform the acceptance of digital game-based educational materials. A long list of constructs found to influence technology acceptance, were purposely omitted from the conceptual model to focus more attention on the most pertinent constructs believed to be relevant to the current study. The framework of the current research study described how, and to what extent, teachers' (a) perceived ease of use, (b) perceived usefulness, (c) relevance, (d) self-efficacy, and (e) experience influenced their acceptance of digital game-based materials. The relevance of these constructs to the current study are discussed in the following sections.

Perceived Ease of Use

Perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320). The effort involved in using digital games in the classroom often comes from finding quality games that connect to the curriculum, which many teachers have expressed as a barrier to implementing DGBM. Four out of five teachers said it is hard to find curriculum-aligned games, and just two out of five believed that a sufficient variety of such games even exist (Takeuchi & Vaala, 2014). No single method has emerged as the most efficient or effective way to identify digital game-based resources, which could mean that teachers are spending an unnecessary amount of time trying to find games to integrate into the curriculum (Sanchez et al., 2016). The limitations of existing games could have a negative impact on teachers' attitudes and perceptions (An, 2018). Perceived ease of use has been found to positively influence technology acceptance (Davis, 1989) and use of

educational video games (Sanchez et al.,2016). Further work in this area may lead to an understanding of how perceived ease of use informs teachers' acceptance of digital game-based materials.

Perceived Usefulness

Perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989, p. 320). Venkatesh and Davis (2000) suggest that knowledge of the actual results of using a system affects behavioral intent. Experiments showing positive correlations between using educational digital games and learning outcomes have led researchers to suggest that using digital game-based instructional materials can improve cognitive gains and attitudes toward learning in students (Alzubi et al., 2018; Galindo, 2018; Hwa, 2018; Vogel et al., 2006). In a meta-analysis of game effectiveness, Ke (2009) determined that 52% of studies reported significant positive effects of computer-based games. This holds true in a meta-analysis where researchers found that digital games were on average more effective than the nongame instructional conditions (Clark et al., 2016). Elementary school teachers have developed different understandings for the usefulness of games, perhaps because of a lack of teachers' knowledge and experiences with game-based learning (Ucus, 2015). Therefore, perceived usefulness of digital games is an important factor to examine.

Relevance

Relevance is defined as "an individual's perception regarding the degree to which the target system is applicable to his or her job" (Venkatesh & Davis, 2000, p. 191). Teachers possess specific knowledge about their job, which they can use as a basis for

determining the relevance of using digital games. For example, teachers know the curriculum and therefore can determine what curriculum related tasks a digital game can perform. Relevance may be related to the degree to which the digital game can provide higher-order learning opportunities. Higher-order thinking and decision-making skills are important attitudes found in classrooms that have adopted digital game-based learning (Nino & Evans, 2015). It has even been realized that games and gamified activities foster higher-order thinking more than factual or verbal knowledge acquisition (Domínguez et al., 2013; Ke, 2009). By demonstrating that games foster higher-order learning opportunities, past research extends the importance of determining K-5 teachers' perceived relevance of DGBM. Venkatesh and Davis (2000) found that job relevance was a determinant of perceived usefulness. These researchers reported that when teachers are given a choice of multiple relevant systems, they have been inclined to choose the system that gives them the highest output quality. However, if teachers perceive DGBM are not relevant, then these researchers say they should be eliminated from consideration, yet these materials exist in today's classrooms.

Self-Efficacy

Self-efficacy refers to teachers' beliefs regarding their ability to use DGBL. In 2008, Venkatesh and Bala defined technological self-efficacy as "individuals' control beliefs regarding his or her personal ability to use a system" (p. 278). These researchers further expounded self-efficacy's relationship to teacher beliefs regarding available resources. They noted that it is unlikely teachers will form stable perceptions of ease of use based on information obtained from others over and above their own general beliefs and hand-on experiences with educational digital games (Venkatesh & Bala, 2008).

Individuals have typically anchored their self-efficacy to general beliefs about a system and later adjusted their view of ease of use based on hands-on experience with the specific system (Venkatesh & Bala, 2008). Teachers have shown improved self-efficacy towards using digital games in the classroom after attending a professional development course and increasing their experiences integrating digital games into their instruction (An, 2018). Further work in examining K-5 teachers' self-efficacy regarding the use of DGBM may lead to a better understanding of how self-efficacy informs acceptance.

Experience

Many teachers felt that their lack of experience, knowledge, and skills in teaching game strategies is a challenge when trying to use educational digital games (Wu, H., 2015). One possible explanation for this is that their lack of knowledge and skills in teaching strategies comes from inexperience with using digital games. Researchers have found that teachers with more experience in teaching with digital games tended to have high self-efficacy in terms of their technological and pedagogical content knowledge (Lee & Tsai, 2010). Other researchers said that elementary school teachers have developed different understandings for the usefulness of games, perhaps because of lack of knowledge and experiences with game-based learning (Ucus, 2015). It is also noted that teachers who play video games, and the frequency with which they do so, positively influenced the frequency of their use of digital games for instructional purposes (Takeuchi & Vaala, 2014). It is speculated that many elementary teachers have experienced using digital game-based and/or gamified materials but collecting data that describe those experiences and how those experiences inform acceptance has never occurred at HSES.

Summary

Learning with digital game-based materials has many qualities that make it worthy of attention in education. The importance has been illustrated by research on the effectiveness of using digital games in educational settings. Past research has highlighted what is known about teachers' acceptance of digital game-based materials and discussed challenges and issues about using digital games for educational purposes. Over the years, the development and application of several models used to describe technology acceptance has called attention to what is known about teachers' acceptance of technology and digital game-based educational materials. Many important factors have been found that influence technology acceptance and digital game-based learning research shows that it has value in education. However, past research studies have not focused on describing how factors such as perceived usefulness, perceived ease of use, relevance, self-efficacy, and past experiences inform elementary teachers' acceptance of digital game-based educational materials. The current research study used a framework based on past technology acceptance models to further investigate questions regarding teachers' acceptance of digital game-based educational materials.

CHAPTER 3: METHOD

The purpose of this mixed-methods action research study was to explore ease of use, usefulness, relevance, self-efficacy, and past experiences to describe influences on Hill Street Elementary School teachers' acceptance of digital game-based materials. The questions this study intended to answer were (1) How, and to what extent, does ease of use influence teacher acceptance of digital game-based educational materials; (2) How, and to what extent, does self-efficacy influence teacher acceptance of digital game-based educational materials; (3) How, and to what extent, does usefulness influence teacher acceptance of digital game-based educational materials; (4) How, and to what extent, does relevance influence teacher acceptance of digital game-based educational materials; (5) How, and to what extent, does experience influence teacher acceptance of digital game-based educational materials?

Research Design

A convergent parallel mixed-methods action research design was most appropriate for this study. I was interested in finding factors that influenced teachers' acceptance of DGBM. I was also seeking an in-depth understanding of how teachers use digital game-based activities in the classroom. I am both a teacher and a researcher seeking to describe teachers' perceptions and attitudes towards using DGBM as a classroom resource. With action research, the researcher is often a classroom teacher working in collaboration with other educators to solve problems of local concern and improve their professional practice (Reeves & Oh, 2017). Action research is a very

localized form of research where the findings directly affect local educational reform, which directly aligns with my goals as a researcher. In a mixed-methods approach, collecting two types of data allows a single researcher to divide the study into tasks and place more emphasis on the qualitative data, the quantitative data, or both equally (Creswell & Creswell, 2018). A mixed-methods design provided the opportunity to use descriptive statistics to identify relationships within the quantitative data as well as a qualitative results that focused on teachers' perceptions and how those perceptions informed acceptance. My intent was to make sense of, or interpret, the perceptions others have about accepting digital games as instructional materials. A descriptive exploration of the elements of acceptance using an interpretivist approach has allowed me to understand the participants and their experiences with this technology.

Descriptive studies rely heavily on interview data. Bogdan and Biklen (2007) explained that a descriptive theory can develop after the first interview, and then revised and modified after each additional interview. Using an interpretivist approach, the researcher views participants as the primary data source, seeking their views, perceptions, and the meanings they hold about the situation being studied (Creswell & Creswell, 2018; Mason, 2002). Thus, the data that emerge are descriptive. That is, data are reported primarily using the participants' words (Creswell & Creswell, 2018). When the types of participants are defined and illustrated using data from the transcripts, the reader is able to better assess how well the defined types describe the actual situation being studied (Shenton, 2004).

Setting and Participants

The name of the school, district, and state where this study was conducted are pseudonyms and all relevant citations have been removed to protect participants' identities. This research study took place at Hill Street Elementary School (HSES), which is a suburban K-5 school within the Kaia County School District (KCSD) and located in Kaia, Wisconsin. According to the Wisconsin Department of Education (WDE), 69.7% of KCSD students in grades 3-8 met or exceeded grade level expectations in 2018. Recent data showed that in 2018 HSES served 952 students, employs 58 teachers, nearly 62% of teachers hold advanced degrees, and almost 83% of teachers are on continuing contracts. The research site was critical to the study because HSES has technologies available for teachers to use digital game-based materials, such as wireless Internet in all classrooms and many devices dedicated for student use, such as laptops, desktops, iPads, and Chromebooks. During the 2020-2021 school year, all student and teacher issued Chromebooks were upgraded.

Applying careful consideration about how the characteristics of a setting will allow the researcher to answer the research questions (Mason, 2002). HSES has classrooms, offices, and intervention rooms dedicated to student learning. Every room accessible to students has a Dell OptiPlex desktop with Windows 10. Every desktop is connected to a 20" monitor and a Smart Board Interactive Display. All kindergarten classrooms have a second Dell OptiPlex desktop with Windows 10 for teacher assistants. In addition to the desktop computers, every grade K-2 classroom has iPads and every grade 2-5 classroom has Dell Chromebooks. HSES has three computer labs and a media center with Dell desktop computers, iPads, and Dell Chromebooks. Classroom teachers

have the means to create a one computer for every student (1:1) technology integration environment, thus allowing every student to use a device capable of running digital game-based applications. Teachers often supplement their allocated devices by borrowing from other classes and checking out devices from the media center or technology classes. The technologies available at HSES indicated that access was not a barrier or conflicting variable in the analysis.

This study used a purposeful sample that consisted of 18 survey participants from grades K-5 and nine interview participants from grades K-4. To collect pertinent data, it was necessary that participants had knowledge of and experiences with using DGBM. An email request for participants (Appendix A) specified that volunteers did not have to currently use DGBM to participate, but they must have prior knowledge of, and experiences with, using DGBM to be a participant in the study. Teachers' depth of knowledge and level of experiences with integrating DGBM into the curriculum did not influence the participant selection process. Purposefully selecting participants allowed for selecting information-rich cases for an in-depth study on the purpose of inquiry and to inform the research questions (Patton, 2002). The purposefully selected sample was critical to the study because HSES employs teachers whose perceptions on the ease of use, usefulness, and relevance of available DGBM are applicable to the study. Purposeful selection was favorable because it could create diversity in the sampling and a variety of themes that intersect in the data (Patton, 2002).

Participant information was anonymized by creating pseudonyms for each participant. A key matching each participant to his/her pseudonym and each neutralized term with its anonymous form was created and kept confidential. All 18 survey

participants were female with teaching experiences ranging from 1-29 years. Fourteen teachers were general education classroom teachers, and the remaining four participants indicated they had specializations in either Math, ELA, STEAM, or Guidance. Thirteen of the participants have earned post-graduate degrees. One teacher-participant reported she taught virtually. Eight of interview participants were female and one was male. All interview participants were face-to-face general education teachers in grades K-4 with 3-19 years of experience. The interview participants held master's degrees in education and three participants had earned a Gifted and Talented teaching certification.

Data Collection Methods

This study collected quantitative and qualitative data to describe how perceptions and experiences informed the acceptance of digital game-based materials. Qualitative data are the systematically and rigorously collected evidence that form the basis of analysis and ground a study to the empirical world (Bogdan & Biklen, 2007). Quantitative research methods revealed statistical information about how many people express certain perceptions, whereas qualitative research methods helped me understand the extent to which those perceptions influenced acceptance.

Data were collected through a survey, one-on-one teacher interviews, and field notes. Table 3.1 outlines the research questions and the data sources I used. The data collected from the survey, individual teacher interviews, and field notes supported the description of how certain perceptions (RQ1-RQ4) and past experiences (RQ5) informed the acceptance of digital game-based educational materials. Triangulating the data collection methods allowed me to richly describe what teachers believed had contributed to or prohibited their acceptance and use of digital games for instructional purposes.

Table 3.1 *Outline of Research Questions and Data Sources*

Research Questions	**Data Sources**
RQ1. How, and to what extent, does perceived ease of use influence teacher acceptance of digital game-based educational materials?	Survey Teacher interview Field notes
RQ2. How, and to what extent, does self-efficacy influence teacher acceptance of digital game-based educational materials?	Survey Teacher interview Field notes
RQ3. How, and to what extent, does usefulness influence teacher acceptance of digital game-based educational materials?	Survey Teacher interview Field notes
RQ4. How, and to what extent, does relevance influence teacher acceptance of digital game-based educational materials?	Survey Teacher interview Field notes
RQ5. How, and to what extent, does experience influence teacher acceptance of digital game-based educational materials?	Survey Teacher interview Field notes

Survey

The first source of data was a 32-item survey titled *Survey of Teachers' Perceptions About Digital Game-Based Materials* (Appendix B). All items used to develop the survey were adapted from existing items previously validated in the academic literature (Appendix C). A questionnaire developed by Sánchez-Mena et al., (2019), which was adapted from Davis (1989), was used to measure teachers' perceived usefulness and perceived ease of use of DGBM. Using confirmatory factor analysis, Sánchez-Mena et al., (2019) found that all items for each factor had factorial loads higher than 0.60 and Cronbach alphas greater than 0.70. Ten items were selected from this questionnaire to measure teachers' perceived usefulness (e.g., "Educational video games improve students learning quality", "Educational video games give students at greater control over their learning process") and four items were used to measure teachers'

perceived ease of use (e.g., “Learning to use educational video games is easy for me”, “I find it easy to use educational video games to teach my classes”). All fourteen items were slightly adapted to fit the current study by changing the phrase *educational video games* to *digital-game-based materials.*

Relevance was measured in the survey using two items adapted from Venkatesh and Davis (2000) and five items adapted from Thompson, Higgins, and Howell (1991). Venkatesh and Davis (2000) conducted four longitudinal field tests and reported that Cronbach’s Alpha for *Job Relevance* “ranged from 0.80 to 0.95 across studies and time periods” (p. 201). Thompson, Higgins, and Howell (1991) reported reliability coefficient (Cronbach’s alpha) of 0.82 for *Job Fit.* The items adapted from Venkatesh and Davis (2000) for this study are “In my job, usage of this system is important” and “In my job, usage of the system is relevant.” These questions were adapted to fit the needs of the current study by changing *the system* to *digital game-based materials*. An example of an item from Thompson, Higgins, and Howell (1991) is “Use of a PC can significantly increase the quality of output of my job.” For the current study, this item was changed to “Use of digital game-based materials can significantly increase the quality of teaching and learning.”

Data regarding self-efficacy were measured using four items (e.g., “I could complete the job using a software package if there was no one around to tell me what to do as I go,” “ I could complete the job using a software package if I had just the built in-help facility for assistance”) from Venkatesh and Bala (2008). The researchers reported reliability of items in that survey were found to be strong, with item loadings greater than or equal to 0.70 (Venkatesh & Bala, 2008). All items were adapted to fit the needs of the

current study (e.g., “I could teach using digital game-based materials if there was no one around to tell me what to do as I go,” “I could teach using digital game-based materials if I had just the material's built-in help features for assistance”).

The Acceptance of Digital Game-Based Learning (ADGBL) survey was developed by Hsu, Liang, Chai, and Tsai (2013) to assess teachers’ acceptance of game-based learning. The ADGBL was found to have strong reliability and validity, explaining 81% of the total variance. The authors reported Cronbach alpha for *Experience with Games* factor was 0.93 and the overall reliability coefficient was 0.96 (Hsu et al., 2013). All five survey items measuring *Experience with Games* (e.g., “I would describe myself as a gamer,” “Compared to people of my age, I play a lot of video games”) were used in their original form for the current study.

Data from the survey instrument were analyzed for internal consistency. Overall, the instrument was found to have strong reliability ($\alpha = .99$) and the reliability of the subscales was also found to have strong alpha values ($\alpha = .90 – .94$), apart from *Perceived Self-Efficacy* ($\alpha = .64$). For convenience in administration and data collection, this survey was administered to participants through Google Forms and presented in a five-point Likert-type scale: 1 = Strongly Disagree; 2 = Disagree; 3 = No Opinion; 4 = Agree; 5 = Strongly Agree.

Teacher Interviews

Participants were invited via e-mail (Appendix A) to take part in a semi-structured interview to obtain information regarding the influences on teachers’ decisions to use or not use digital games. Each interview lasted 60-90 minutes. The interviews were video recorded and transcribed using Otter.ai. The transcription was checked against the video

recording to correct any errors. Participant information was anonymized by creating pseudonyms for each participant. A key matching each participant to his/her pseudonym was created and kept confidential. Table 3.2 aligns the interview questions with the research questions.

Table 3.2 *Interview Protocol for Research Questions*

Research question	**Constructs**	**Interview focal question**
RQ1. How, and to what extent, does perceived ease of use influence teacher acceptance of digital game-based educational materials?	Ease of use	Can you describe for me the effort you feel it would take for you to use a digital game-based material in a lesson or activity?
RQ2. How, and to what extent, does self-efficacy influence teacher acceptance of digital game-based educational materials?	Self-efficacy	Can you please describe your personal ability to use digital game-based materials in a lesson or activity?
RQ3. How, and to what extent, does usefulness influence teacher acceptance of digital game-based educational materials?	Usefulness	What is your opinion about the usefulness of digital game-based materials?
RQ4. How, and to what extent, does relevance influence teacher acceptance of digital game-based educational materials?	Relevance	How relevant do you find digital game-based materials to your teaching methods?
RQ5. How, and to what extent, does experience influence teacher acceptance of digital game-based educational materials?	Experience	Can you give me an example of using digital game-based materials in your classroom?

An interview protocol (Appendix D) was used to conduct the semi-structured individual interviews. The interview protocol was aligned with my research questions and

contained lead questions and probing questions related to what influences teachers' decisions to use or not use digital games for instructional purposes. As this study was descriptive in nature, the questions aimed to engage the participants in conversations about their past experiences using digital games in the classroom, how they believe their perceptions and past experiences have informed their decision to use or not use digital games, and their overall acceptance of digital game-based materials. Probing questions were designed to engage participants in a conversation about their personal gaming experiences and perceived influences on the digital game-based experiences they created for their students. After analyzing the data, member checking took place to see if participants believe that their words match their intended messages, to see that I have represented their ideas correctly, and to verify my emerging theories (Mertler, 2017; Shenton, 2004). This was conducted in follow-up meetings with participants in the study.

The semi-structured interview script started with an introduction explaining the steps that taken to ensure confidentiality, describing the purpose of the interview, and checking for understanding of certain terms and definitions. Then the interview began with questions pertaining to personal information, such as "How many years have you been teaching? and What is your educational background?" Then the interview used an open-ended question related to perceived ease of use (RQ1), followed by probing questions. The interview proceeded in the same format, using constructs from RQ2-4. These procedures were repeated for every teacher interview.

Semi-structured interviews are defined as "interviews in which the same general questions or topics are brought up to each of the subjects involved" (Bogdan & Biklen, 2007, p. 275). Interviews are a valid way to collect data by interacting with people and

capturing their perceptions and experiences in their own words (Bloomberg & Volpe, 2012). Advantages of conducting interviews include collecting and preserving data through the use of digital recording and transcription, having control of the questioning, and having opportunities to ask probing questions if I needed to clarify the participant's responses (Creswell & Creswell, 2018; Mertler, 2017). By conducting semi-structured interviews, I was able to bring about the teacher's perspective regarding the integration and use of DGBM in his or her teaching methods. The purpose of this research study was to describe influences on elementary teachers' acceptance of digital game-based materials; therefore, it was important to gain individual teacher perceptions of certain factors that may influence acceptance. Teacher interviews provided personal perspectives related to factors of acceptance (see Chapter 2), such as perceived ease of use (RQ1), self-efficacy (RQ2), usefulness (RQ3), and relevance (RQ4).

Field notes

Recording field notes in a journal was an important data collection method that spanned the entire data collection period. Through this data collection method, I was able to capture situational meaning, interview context, my thoughts, my assumptions, and general impressions of participant observations. Bogdan and Biklen (2007) referred to field notes as the researcher's personal log, where the researcher can record the study's development, visualize how the study has been affected by the data, and remain cognizant of how he or she may be influenced by the data. These notes were recorded often after short spans of observations because details are often lost if not noted right away (Lune & Berg, 2017). Field notes aided this research study by allowing me to record comments about situational factors, such as environmental contexts, behaviors,

and nonverbal cues, which may not be represented in the audio or video recordings (Sutton & Austin, 2015). Examples of field notes are brief observations, detailed descriptions, analytic notes, and/or subjective reflections (Lune & Berg, 2017).

Data Analysis

Quantitative and qualitative data was analyzed to describe how perceptions and past experiences inform teachers' acceptance of digital game-based educational materials. Data from the survey was analyzed with descriptive statistics, while the one-on-one teacher interviews and field notes were analyzed inductively to create codes, categories, and themes. Data analysis began early in the study, starting with the transcription from the first teacher interview. Table 3.3 aligns the research questions with the data sources and the methods of analysis. A full description of the analyses is included later in Chapter Four.

Table 3.3 *Research Questions, Data Sources, and Methods of Analysis*

Research Questions	**Data Sources**	**Methods of Analysis**
RQ1. How, and to what extent, does perceived ease of use influence teacher acceptance of digital game-based educational materials?	Survey Teacher interview Field notes	Descriptive Statistics Thematic analysis
RQ2. How, and to what extent, does self-efficacy influence teacher acceptance of digital game-based educational materials?	Survey Teacher interview Field notes	Descriptive Statistics Thematic analysis
RQ3. How, and to what extent, does usefulness influence teacher acceptance of digital game-based educational materials?	Survey Teacher interview Field notes	Descriptive Statistics Thematic analysis

Research Questions	Data Sources	Methods of Analysis
RQ4. How, and to what extent, does relevance influence teacher acceptance of digital game-based educational materials?	Survey Teacher interview Field notes	Descriptive Statistics Thematic analysis
RQ5. How, and to what extent, does experience influence teacher acceptance of digital game-based educational materials?	Survey Teacher interview Field notes	Descriptive Statistics Thematic analysis

Survey

Quantitative data were collected using a survey and scored on a five-point Likert-type scale: 1 = Strongly Disagree; 2 = Disagree; 3 = No Opinion; 4 = Agree; 5 = Strongly Agree. Descriptive statistics for the survey scores were calculated and summarized for perceived usefulness, perceived ease of use, relevance, self-efficacy, and experience. Tables of descriptive statistics detailing the means and standard deviations to summarize and describe the participants' responses are presented in Chapter 4.

Teacher Interviews

Participants' interviews were video recorded, transcribed using Otter.ai, formatted to a Microsoft Word document, and uploaded to Delve, a qualitative data analysis tool. The transcription was checked against the video recording for any errors. Analysis of teacher interview transcriptions began immediately following the first interview. Memos of my initial thoughts were inserted as comments. To identify emerging themes from the teacher interviews, the data was examined through three rounds of analysis: coding, using codes to develop categories, and finally using the categories to develop themes. Accurate and descriptive documentation of the process was recorded in a journal. Identified themes

were summarized in a table to serve as a framework for reporting the findings (see Chapter 4).

Rigor & Trustworthiness

Research methods that are comprehensive, systematic, and evaluative add rigor and trustworthiness to a study (Onwuegbuzie & Corrigan, 2014). Techniques that promote credibility, dependability, confirmability and transferability will increase the rigor and trustworthiness in a qualitative study (Guba, 1981). To increase rigor and trustworthiness to my research methods, I used (a) methodological triangulation, (b) thick description, (c) peer debriefing, (d) member checks, and (e) an audit trail.

Methodological Triangulation

This study triangulated data from the survey, teacher interviews, and field notes to establish themes. Triangulation, the process of using multiple data collection methods and drawing on multiple sources of data, served to support the trustworthiness of the research findings and reduce the chances of misinterpretations about a research problem (Bloomberg & Volpe, 2012; Creswell & Creswell, 2018; Mertler, 2017). An important aspect of triangulation is to not only combine multiple data collection techniques, but to connect them to reduce the threats to rigor and trustworthiness acknowledged in each alone (Lune & Berg, 2017). Through the use of overlapping methods, triangulation can also increase the dependability and credibility of a study (Shenton, 2004).

Thick Description

In this study, comments from teacher interviews and field notes were analyzed and described to provide ample details about teacher perception of using digital games in the classroom. Rich, thick description, including direct quotes from the participants, add

rigor and trustworthiness to the study. Thick description promotes credibility because it helps express the actual conditions that have been investigated and the contexts around them (Shenton, 2004). Massey, (2011) suggested that these details "can be offered to buttress any conclusions drawn by the evaluator and quotations may be used to corroborate findings" (p. 24). Because findings of qualitative research are specific to the sample and context being studied, it is impossible for a researcher to demonstrate transferability (Shenton, 2004). However, providing a thick description of the phenomenon being studied will allow readers to compare the findings with those they have observed in their context, thus allowing the reader to judge the transferability of the results.

Peer Debriefing

Frequent debriefing sessions between the researcher and the dissertation chairperson were held to discuss the analytic procedures and perceptions. In addition to my research methods prior to data collection, the codes, categories, and themes created during data analysis were discussed with my dissertation chairperson and documented in the researcher journal. Elliott, Fischer, and Rennie (1999) discussed the importance of using an additional analytic auditor to look for discrepancies, overstatements, or errors in the data as a credibility check. Peer debriefing can improve analysis, suggest alternative approaches, recognize unintended biases, and ensure the investigation is thorough and rigorous (Bloomberg & Volpe, 2012; Shenton, 2004). During initial coding, peer review of the analysis occurred with my dissertation committee chair. Suggestions were made to recode certain process codes to uncover how these processes were occurring. For example, after further analysis the process code *Preparing* contained lines of text that

indicated ways in which teachers were preparing. *Preparing* was one of several codes that was subcoded during First to Second Cycle Coding. Through the critique of data collection and analysis, peer debriefing helps the researcher reflect on the research and adds validity to the interpretation (Creswell, 2014; Mertler, 2017). Peer debriefing increases credibility because it provides an audience for the researcher to test interpretations and probe for unrecognized biases (Shenton, 2004).

Member Checks

The transcripts were cross-checked with the video recordings and edits were made to ensure the text was accurate. Analytic memos were inserted as comments on the transcripts. Member checking occurred a few times during this process to clarify participants' statements. For example, a note was made in the researcher's journal regarding contacting one participant, Brenda, about clarifying one of her statements. Later, an email was sent to her telling her my impression of her response and asking her if I was correct. She replied in a later email confirming my assumption. Member checks add credibility to a study by ensuring that the researcher has represented participants' ideas correctly and as verification of emerging theories (Mertler, 2017; Shenton, 2004). Corroborating procedures of checking to ensure the research is sound and the findings are trustworthy add rigor and trustworthiness to a study (Creswell, 2014).

Audit Trail

An audit trail will show documentation of my actions and decisions in a researcher journal. Throughout the study, I used a journal to record observations, initial impressions, emerging patterns, assumptions, and interpretations. This was done by writing memos on interview transcripts about initial codes and categories, recording

initial interpretations of the interview process, detailing how codes and categories were created during data analysis, recording reasons why categories were shaped into themes, and describing emerging interpretations and suppositions. An audit trail assisted the research in creating a reflective commentary, which added confirmability and credibility to the study because it promoted confidence that I had accurately recorded the phenomena being studied (Shenton, 2004). Mertler (2017) described this process as *reflexivity* and defined it as "the process of integrating your own preliminary thoughts and interpretations with your actual observation notes" (p. 207). An audit trail is an important element that provides a full justification for a researcher's decisions and explicitly records the route the researcher took creating codes, categories, themes, interpretations, and assertions (Mason, 2002). Shenton (2004) states that a researcher's reflective commentary should seek to monitor the emerging constructions and evaluate the effectiveness of the research methods. Writing up field notes in a journal, distinctly marking them to differentiate from raw data, and precoding salient information enhanced the audit trail and provided evidence to readers of the analysis of my findings (Witt, 2013).

Plan for Sharing and Communicating Findings

Sharing and communicating the findings of this study will provide valuable information regarding teachers' collective perceptions of the usefulness of digital games for instructional purposes. Participant pseudonyms will be used to protect the identity of the teachers. Lune and Berg (2017) recommend using technology for communicating the findings in an "interesting, engaging, and accessible manner" (p. 140). A slideshow using Microsoft PowerPoint will be created to help describe specific aspects of the study, such

as the purpose of the study, the setting/context of the study, research questions, methods of data collection, methods of data analysis, the results of the analysis, and the recommendations for future practice and research. In a brief meeting, I will use the slideshow to provide the participants with information regarding the results of the study and my recommended action plan. I plan to share and communicate the findings with the participants of the study first, then with the staff at HSES, then the Kaia County School District Board of Trustees, and finally presenting at applicable conferences. In a brief meeting using the PowerPoint as a visual aid, I will provide the participants with information regarding the results of the study and my recommended action plan. This presentation will allow a final round of participant member checking to take place.

After findings have been presented to the participants, I plan to present my findings to the staff at HSES. The results of my findings may provide information regarding future plans for professional development in using digital games in the classroom. During a larger presentation such as this, it is recommended to include more aspects of the study, such as background information, the purpose of the study, the methodology, the results, my conclusions, and the recommended action plan (Mertler, 2017). I will ask the audience to record any questions they have either on paper or through an audience feedback tool such as eventScribe, Poll Everywhere, or Sendsteps. Finally, there will be time for additional questions and answers at the end of the presentation. I plan to use the same PowerPoint as a visual aid. The implications on professional development decisions that my study could inform will be valuable information for the administrators at HSES.

After findings have been presented to the staff, I plan to present my findings to my district's school board. Because of a 1:1 technology integration initiative, my school district is currently promoting the use of best practices in educational technology. Many teachers across the district receive training and professional development to use new and engaging forms of educational technology. The results of my findings may provide the district information regarding future plans to invest in resources and professional development in using digital games in the classroom. I plan to use the same website as a visual aid, however I will situate the action plan in the context of the school district. The action plan will tailor to an audience of district directors and school board members who are also business leaders in the community. The implications on budgetary decisions that my study could inform will be valuable information for the board.

There are numerous conferences that can benefit from the results of this study. Reporting the findings at applicable conferences available at the conclusion of this study will be considered. Based on my findings, my session at conferences may include recommendations for professional development and/or descriptions of best practices related to integrating digital game-based activities into the elementary classroom.

Sharing and communicating the findings of this study will inform future practices. Teachers may use the results to inform their future decisions about learning how to use digital games for instruction. School administrators and district officials may use the results to inform the use of resources and professional development. Understanding the factors that contribute to accepting digital games for instructional purposes may lead to better professional development opportunities within my district.

The results of my study will also inform implications for future research. Given the means and the opportunity, this study is the first of several studies I plan to conduct. The purpose of this study was to describe current conditions regarding teachers' perceptions of digital game acceptance. Future cycles of this research study will include describing how perceptions and experiences inform acceptance and use among varying demographics and teaching contexts, analyzing acceptance factors believed to influence teacher acceptance of digital games in order to determine what, if any, correlation exists among those factors, describing the outcome of professional development on teacher acceptance of DGBM, evaluating any digital game-based initiative KCSD elementary schools are considering purchasing or have already purchased, and investigating what happens when a digital game-based intervention is implemented to improve outcomes.

CHAPTER 4: ANALYSIS AND FINDINGS

The purpose of this research study was to explore ease of use, usefulness, relevance, self-efficacy, and past experiences to describe influences on elementary teachers' acceptance of digital game-based materials. The questions this study intended to answer were (1) How, and to what extent, does ease of use influence teacher acceptance of digital game-based educational materials; (2) How, and to what extent, does self-efficacy influence teacher acceptance of digital game-based educational materials; (3) How, and to what extent, does usefulness influence teacher acceptance of digital game-based educational materials; (4) How, and to what extent, does relevance influence teacher acceptance of digital game-based educational materials; (5) How, and to what extent, does experience influence teacher acceptance of digital game-based educational materials?

Data for the study were collected in a mixed-methods approach. The purpose of collecting survey data was to use descriptive statistics to summarize and describe the participants' responses. The purpose of collecting qualitative data was to identify emerging themes from the teacher interviews. Both methods yield information about how perceived ease of use, perceived usefulness, perceived relevance, self-efficacy beliefs, and past experiences inform teachers' acceptance of digital game-based educational materials. Findings from the (a) quantitative data analysis and the (b) qualitative data analysis are presented below.

Quantitative Findings

A survey about teachers' perceptions about DGBM was administered to participants through Google Forms. Data from the survey instrument were collected in a spreadsheet. Survey items were then numbered and separated by concept. Internal reliability of the instrument and subscales were calculated using Jeffreys's Amazing Statistics Program (JASP). Next, means and standard deviations were calculated for each item, as well as each subscale, using Excel and verified with JASP. The following sections detail (a) survey descriptions, (b) analysis of item internal consistency, (c) participant demographics, and (d) descriptive statistics.

Survey Description

A 36-item survey titled *Survey of Teachers' Perceptions About Digital Game-Based Materials* (Appendix B) anonymously collected K-5 teachers' information regarding personal attributes and perceptions about acceptance factors found to influence behavioral intent and use of technology. All items used to develop the survey were adapted from previously validated items from four different technology acceptance surveys. The survey rating scales were 1 = Strongly Disagree; 2 = Disagree; 3 = No Opinion; 4 = Agree; 5 = Strongly Agree. The survey was distributed to K-5 teachers at HSES (n = 43). Items in the survey were organized into subscales based on constructs identified in the research questions: perceived usefulness, perceived ease of use, perceived relevance, perceived self-efficacy, and experience.

Internal Consistency

The survey used in the current study was found to have strong reliability (α = .99). The reliability of the subscales was also tested and found to have strong alpha values

(α = .90 – .94), apart from *Perceived Self-Efficacy* (α = .64). Table 4.1 depicts the reliability of the instrument subscales.

Table 4.1 *Subscale Reliability Statistics (n=18)*

Subscale	**Cronbach's Alpha**
Perceived Usefulness (items 7-16)	.95
Perceived Ease of Use (items 17-20)	.90
Perceived Relevance (items 21-27)	.91
Perceived Self-Efficacy (items 28-31)	.67
Experience (items 32-36)	.94

Participant Attributes

A purposeful sample of 18 participants from grades K-5 at Hill Street Elementary School (HSES) volunteered to participate in the survey. The purposefully selected sample was critical to the study because HSES employs teachers whose experiences with, and perceptions of DGBM are applicable to the study. The tables in this section describe the relevant participant demographic information. All 18 survey participants were female, with many reporting that they have been teaching for 11-15 years (Table 4.2).

Table 4.2 *Number of years teaching at the primary and/or elementary level (n=18)*

Years	**Number of Participants**	**Percentage of Participants**
0	1	5.56%
1-5	1	5.56%
6-10	4	22.22%
11-15	7	38.89%
16-20	2	11.11%

Years	Number of Participants	Percentage of Participants
21-25	2	11.11%
26-30	1	5.56%

Note. A score of 0 indicates a first-year teacher.

Table 4.3 describes the subject matter that each participant teaches. The survey participants were teachers at Hill Street Elementary School, but not all of them were general education classroom teachers. Fourteen teachers reported that they teach all core subjects (Math, ELA, Science, Social Studies, and Health). Two teachers reported that they specialize in only one subject. HSES employs specialists and interventionists in Math and ELA. These teachers work with students in grades K-5 that are performing below grade level expectations. Two additional participants indicated that they are teachers of the arts. HSES employs eight teachers for its Related Arts curriculum (Art, Music, Physical Education, Technology, STEAM, Media, and Guidance).

Table 4.3 *Participant Subject Areas (n=18)*

Subject	Number of Participants	Percentage of Participants
General education	14	77.77%
Math Specialist	1	5.56%
ELA Specialist	1	5.56%
Related Arts	2	11.11%

Table 4.4 shows that many of the survey participants hold postgraduate degrees and Table 4.5 shows that all but one of the participants teach face to face. At the time this research study began, all the teachers who volunteered were teachers at HSES. However,

one participant completed the survey after she had become a virtual elementary school teacher within the same school district as HSES.

Table 4.4 *Participant Postgraduate Degrees (n=18)*

Graduate Degree	**Number of Participants**	**Percentage of Participants**
Yes	13	72.22%
No	5	27.78%

Table 4.5 *Participant Teaching Context (n=18)*

Context	**Number of Participants**	**Percentage of Participants**
Virtual	1	5.56%
Face to face	17	94.44%

Subscale Descriptive Statistics

Mean and standard deviation scores for constructs believed to influence the use of digital game-based materials were calculated using Microsoft Excel. Table 4.7 presents the descriptive statistics for instrument subscales Perceived Usefulness, Perceived Ease of Use, Perceived Self-Efficacy, Perceived Relevance, and Experience. Perceived Self-Efficacy (Items 28-31) had the highest mean and a low standard deviation (M = 4.04, SD = 0.98). Also noteworthy is Perceived Ease of Use (M = 4.01, SD = 0.99). Experience had the lowest mean and the highest standard deviation (M = 2.10, SD = 1.06). The remaining subscales include Perceived Usefulness (M = 3.71, SD = 0.85) and Perceived Relevance (M = 3.56, SD = 0.98).

Table 4.6 *Subscale Descriptive Statistics (n=18)*

Subscale	***M***	***SD***
Perceived Usefulness (items 7-16)	3.79	0.98
Perceived Ease of Use (items 17-20)	4.01	0.99
Perceived Relevance (items 21-27)	3.70	1.04
Perceived Self-Efficacy (items 28-31)	4.04	0.98
Experience (items 32-36)	2.10	1.06

Item Descriptive Statistics

After the survey was administered, descriptive statistics were calculated using Microsoft Excel and verified using JASP. Means and standard deviations of all 36 items were calculated and are presented in Table 4.6. Items 17 *Learning to use digital game-based materials is easy for me* (*M* = 4.06, *SD* = 0.94) and 22 *In my job, usage of digital game-based materials is relevant* (*M* = 4.17, *SD* = 0.99) were found to be significant. Items 32 *I would describe myself as a gamer* (*M* = 2.06, *SD* = 0.94) and 33 *Compared to people of my age, I play a lot of digital games* (*M* = 1.67, *SD* = 1.03) were found to be insignificant.

Table 4.7 *Survey Items Descriptive Statistics (n=18)*

Survey Item	***M***	***SD***
7. Digital game-based materials improve students' learning quality.	3.89	0.83
8. Digital game-based materials give students a greater control over their learning process.	3.67	1.03
9. Digital game-based materials enable students to learn more quickly.	3.83	0.86
10. Digital game-based materials support critical aspects in the students' learning process.	3.67	1.03
11. Digital game-based materials increase students' productivity.	3.78	0.88

Survey Item	*M*	*SD*
12. Digital game-based materials improve students' learning performance.	3.83	0.99
13. Digital game-based materials allow students to learn more than would otherwise be possible.	3.67	1.24
14. Digital game-based materials enhance students' learning effectiveness.	3.78	0.88
15. Digital game-based materials make it easier for students to learn.	3.89	1.08
16. Overall, I find digital game-based materials useful for learning.	3.93	0.96
17. Learning to use digital game-based materials is easy for me.	4.06	0.94
18. I find it easy to use digital game-based materials in my classroom.	4.06	1.14
19. Digital game-based materials are clear and understandable for me.	4.00	0.84
20. Overall, I would find digital game-based materials easy to use.	3.94	1.06
21. In my job, usage of digital game-based materials is important.	3.78	1.17
22. In my job, usage of digital game-based materials is relevant.	4.17	0.99
23. Use of digital game-based materials will have no effect on the performance of my job.	3.33	1.03
24. Use of digital game-based materials can significantly increase the quality of teaching and learning.	3.65	1.00
25. Use of digital game-based materials can increase the effectiveness of performing my job.	3.50	1.10
26. Use of digital game-based materials can increase the quantity of teaching and learning for the same amount of effort.	3.53	1.01
27. Considering teaching and learning, the general extent to which use of digital game-based materials could assist me in my job.	3.94	1.00
28. I could teach using digital game-based materials if there was no one around to tell me what to do as I go.	3.88	0.93
29. I could teach using digital game-based materials if I had just the material's built-in help features for assistance.	3.94	0.87
30. I could teach using digital game-based materials if someone showed me how to do it first.	4.22	1.06
31. I could teach using digital game-based materials if I had previously used similar teaching methods.	4.12	1.05
32. I would describe myself as a gamer.	2.06	0.94
33. Compared to people of my age, I play a lot of digital games.	1.67	1.03
34. I play different types of digital games.	1.94	1.11
35. I often play digital games.	1.94	1.06

Survey Item	*M*	*SD*
36. I like playing digital games.	2.89	1.18

Qualitative Data Analysis

This study collected qualitative data in two forms: individual teacher interviews and field notes. Nine individual teacher interviews were conducted to enhance the data on teachers' perceptions collected in the survey. Whereas the survey reveals the frequency and extent of acceptance perceptions, one-on-one teacher interviews clarifies how and why those perceptions influence acceptance. Field notes were written on a Google Doc throughout the data collection and analysis processes. These field notes documented the steps taken during data collection and analysis, the researcher's thoughts and questions, screen shot images of analytic memos written on participant transcripts, screen shot images of the coding, recoding, subcoding processes using Delve, and photographs of the steps the researcher took to create categories and themes. Table 4.8 outlines the information gathered after analyzing the interview transcripts and field notes.

Table 4.8 *Summary of Qualitative Data Sources*

Types of Qualitative Data Sources	Number	Total Codes Applied
Individual teacher interviews	9	291
Field Notes	1	11

Analysis of Qualitative Data

The information gathered from the individual teacher interviews occurred through many cycles of detailed analysis. Teacher interviews were conducted virtually using Google Meet, which features a screen recording tool. While video

recording the interview, a transcription of the interview was also created using Otter.ai. Several of the Otter transcripts had errors. This was most likely due to external microphone issues, so new transcripts were created by playing the video recording and launching Otter without using an external microphone. The transcripts were cross-checked with the video recordings and edits were made to ensure the text was accurate. Analytic memos were inserted as comments on the transcripts. Member checking occurred a few times during this process to clarify participants' statements. For example, a note was made in the research's journal regarding contacting one participant, Brenda, about clarifying one of her statements. Later, an email was sent to Brenda telling her my impression of her response and asking her if I was correct. Brenda replied in a later email confirming my assumption.

First cycle coding. Once the transcripts were ready for coding, they were uploaded to Delvetool.com. First cycle coding began with attribute and structural coding. Attribute coding assisted in analyzing demographic data coming from the interview questions pertaining to personal information, such as *How many years have you been teaching?* and *What is your educational background?*. Saldana (2013) describes attribute coding as the coding of basic descriptive information. Each demographic question became an attribute code, and the participants responses were coded accordingly. Table 4.9 lists the demographic questions and their corresponding attribute code. Two questions, *What subject area do you currently teach?* and *Do you teach virtually?* were not coded because every participant's answer was almost identical and did not contribute to the study.

Table 4.9 *Attribute Codes*

Interview Questions	Codes Applied
How many years have you been teaching?	Years teaching
What grades have you taught?	Grades taught
What grade are you currently teaching?	Current grade
Do you have any graduate degrees?	Graduate degrees
What teaching certifications do you have? Do you have any additional certifications?	Certifications

Structural coding then took all the responses pertaining to research question one and coded them into RQ1, all responses pertaining to research question two and coded them into RQ2. This type of coding continued for RQ3, 4, and 5. Structural coding large segments of data related to the research questions allows the researcher to then examine each segment for additional coding and analysis (Saldana, 2013). Table 4.10 outlines the research questions and corresponding structural codes.

Table 4.10 *Structural Codes*

Research Questions	Codes Applied
RQ1: How, and to what extent, does ease of use influence teacher acceptance of digital game-based educational materials?	RQ1 ease of use
RQ2: How, and to what extent, does self-efficacy influence teacher acceptance of digital game-based educational materials?	RQ2 self-efficacy
RQ3: How, and to what extent, does usefulness influence teacher acceptance of digital game-based educational materials?	RQ3 usefulness
RQ4: How, and to what extent, does relevance influence teacher acceptance of digital game-based educational materials?	RQ4 relevance

Research Questions	Codes Applied
RQ5: How, and to what extent, does experience influence teacher acceptance of digital game-based educational materials?	RQ5 experience

Simultaneous coding was the next stage completed in First Cycle Coding. The RQ1 section of one participant's transcript was analyzed and several types of codes were generated. I began by lumping my probing question and the participant's response together, then values coding as either *Positive* or *Negative*. According to Saldana (2013), values coding is "the application of codes onto qualitative data that reflect a participant's values, attitudes, and beliefs" (p. 110). Values coding of the transcripts looked for data that I interpreted to be either positive or negative perceptions related to the acceptance of digital game-based materials. Then I analyzed the participant's response again, this time simultaneously coding lumped units of text with concept codes. Often, and entire response given by a participant described a concept or idea and splitting the text would be invaluable. One example occurred while reading Jessica's response about the possibility of using Kahoot with 1:1 devices in the classroom. She said,

> Jessica When we have eight grade levels, or eight classes on our grade level, and if everybody's doing Kahoot on Thursday afternoon, well, then I can't borrow hers and there wouldn't be enough devices, even if we went to the lab, there wouldn't be enough devices for all of our kids to have one. And then the effort it would take to try and go, Oh, well, maybe we could borrow it from this grade level, then you're back to, it's too time consuming to try and do all that.

This lumped text was coded *Pros and cons of not having enough devices*. Saldana (2013) explains that lumping text is a practical coding method that allows for future subcoding.

Lastly, initial coding employed process coding and in vivo coding was conducted to further analyze the transcripts and record the participants' meaning and intent. These codes were generated by splitting the participant's response for a more nuanced analysis. Splitting the participants' responses sentence by sentence became my primary unit of analysis. Process coding, the use of gerunds to code action in the data (Saldana, 2013), looked for responses pertaining to using digital games. For example, some participants discussed taking their class to the computer lab to use a DGBM, so the process code "using the computer lab" was created.

In vivo coding uses the actual terms found in the transcripts as codes, which is particularly helpful with qualitative action research because it enhances the researcher's understanding of the participant's views (Saldana, 2013). While analyzing one participant's response regarding how DGBM impacts planning, Kevin stated, "I mean just giving me one more resource that I can use. One more tool in my toolkit." Both sentences were coded as "One more tool in my toolkit" (see Figure 4.1)

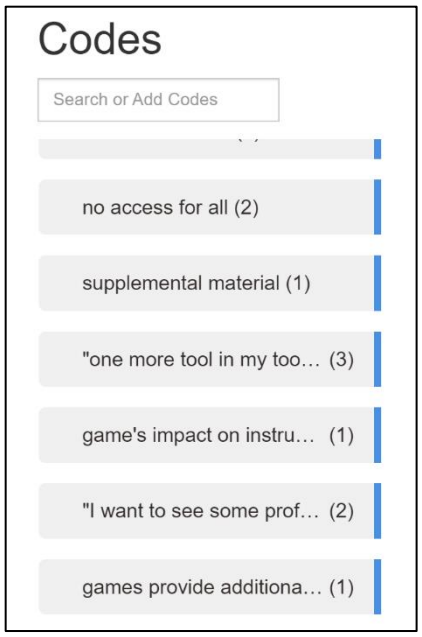

Figure 4.1 *Screenshot of In Vivo Codes in Delve indicated with quotation marks.*

As codes were generated, a description of that code was created and stored in Delve (Figure 4.2), which would guide future coding and categorizing. This method of simultaneously creating value code, concept codes, in vivo codes, and process codes was repeated with the RQ1 section of the remaining transcripts.

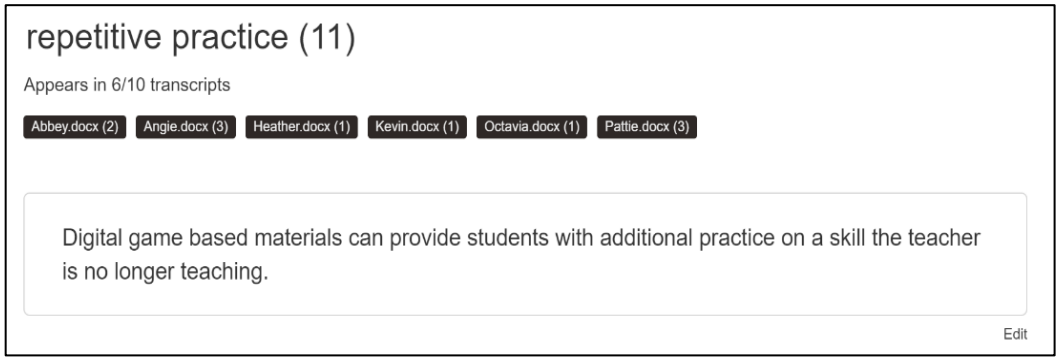

Figure 4.2. *Screenshot of operationalized code in Delve.*

Assumptions and general impressions of the codes related to RQ1 were recorded in the researcher's journal. During this phase of qualitative analysis, peer review of the analysis occurred with my dissertation committee chair. Suggestions

were made to recode certain process codes to uncover how these processes were occurring. For example, after further analysis the process code *Preparing* contained lines of text that indicated ways in which teachers were preparing. *Preparing* was one of several codes that was subcoded during First to Second Cycle Coding. The transcript analysis methods used for the RQ2, RQ3, etc. sections of each participant's transcript followed the same pattern and sequence mentioned above.

First to second cycle coding. After First Cycle Coding was complete, subcoding and recoding using previously described First Cycle methods occurred. This was done to provide a more precise and rich set of codes before beginning Second Cycle Coding. Saldana (2013) refers to this process of drawing on as eclectic coding. Several concept codes were created during First Cycle Coding that needed another round of analysis to subcode them into more precise units of data using in vivo codes and process codes. For example, *Engagement* was an early First Round Code that included 105 units of text. This code was far too broad to keep as a First Round Code. Delve was used to create a Snippet for the Engagement code. Then, a new analysis of all 105 units of text yielded 21 new subcodes of Engagement (see Figure 4.3). Also, during this cycle of data analysis some codes subsumed other codes or were combined to form new codes. For example, Figure 4.4 illustrates that the code A*uthentic use - "intentional"* subsumed *Helpful and useful for the students* because the single unit of text within *Helpful and useful for the students* quoted Octavia saying, "And like (the) material, I want it to be something that is actually helpful and useful for them, the material they are

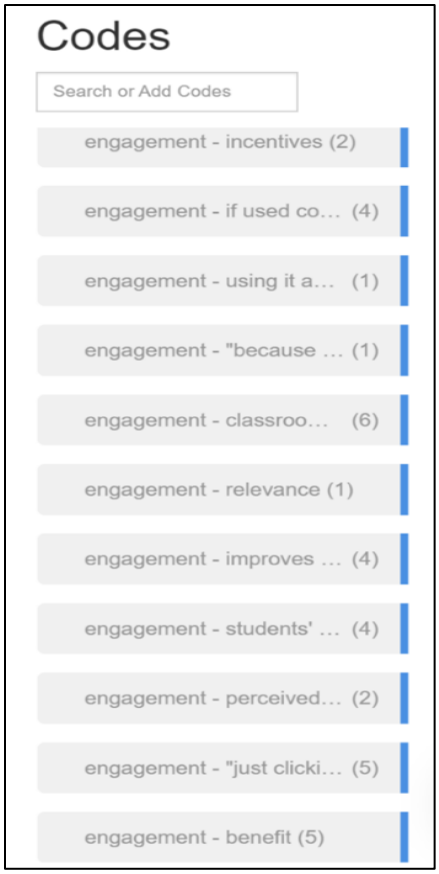

Figure 4.3 *Screenshot of* Engagement *subcodes in Delve.*

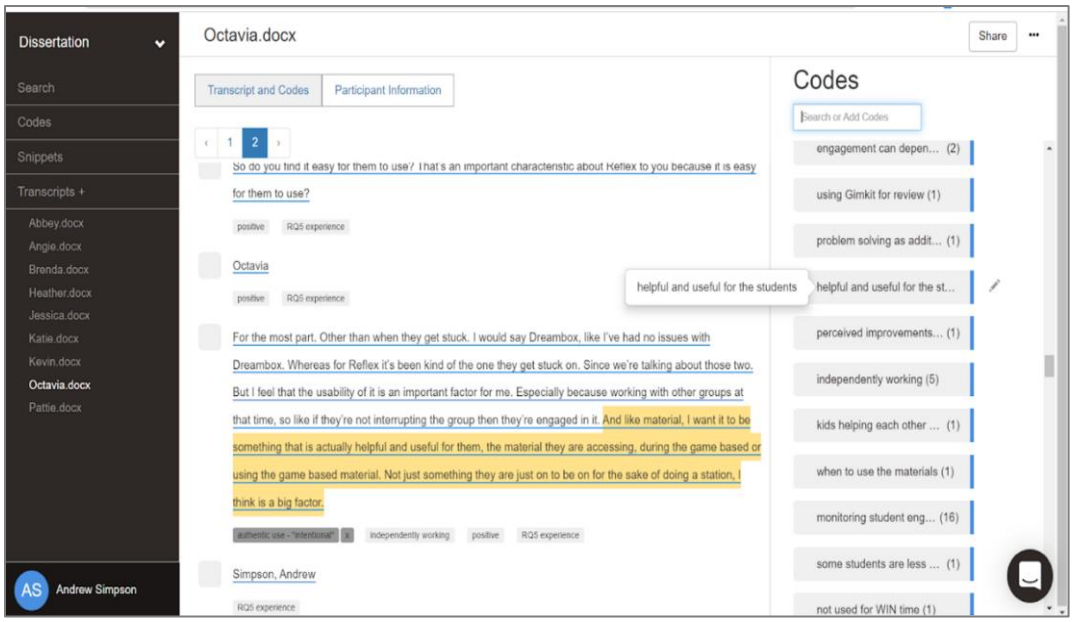

Figure 4.4 *Screenshot of the code* Authentic use - "intentional" *subsumed by* Helpful and useful for the students.

accessing, during the game based or using the game based material." Octavia expresses her desire to want to intentionally use DGBM that are helpful and useful for the students.

Second cycle coding. Categories of codes were created during Second Cycle Coding. This process began by downloading all the codes from Delve into an Excel spreadsheet. All the columns in the spreadsheet were removed except the *Code Name* and *Description* columns. The spreadsheet was then resized and reformatted for space, printed, cut apart, and sorted on a table (see Figure 4.5). For example, the code *Planning - device availability* was combined with several other codes including *Relevance based on availability of resources*, *Not afraid to ask people for help*, and several others to create the category *Resources*.

Figure 4.5 *Image of codes sorted on a tabletop.*

The codes *Planning - used as an afterthought* and *Planning – intentionality* were combined with many other *Planning* subcodes and *Authentic use* subcodes to create the category *Teachers' authentic use* because several snippets of text within the subcodes revealed participants statements about planning authentic experiences using DGBM. The codes *Planning - explore to find out more about the game* and *Preparing - student view* were combined with many *Self-efficacy* subcodes to create the *Self-efficacy* category because the codes contained snippets of text where participants expressed confidence with their ability to create a student profile to explore the game from the student's point of view. Category titles based on the codes in each pile were written on an envelope and all the codes were placed inside the envelope. The envelopes were then sorted into categories to identify possible themes (see Figure 4.6).

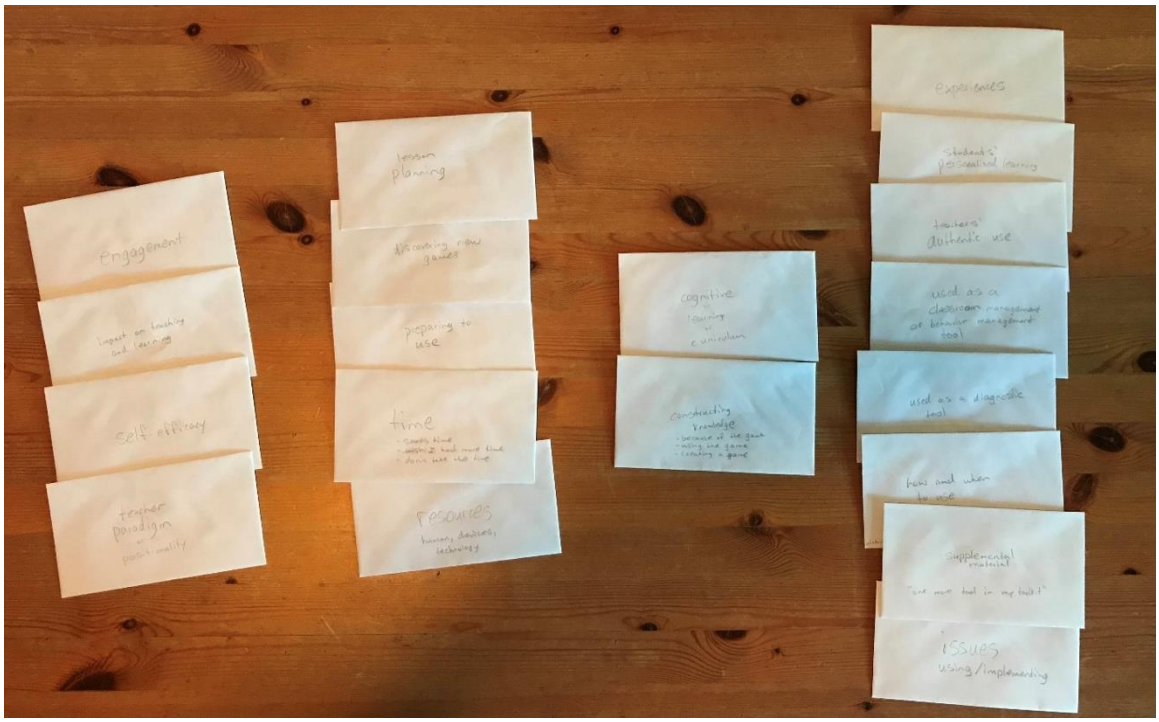

Figure 4.6 Image of categories sorted on a tabletop.

To combine categories, a concept map was developed (see Figure 4.7). The concept map highlighted several categories that were connected to others, thereby indicating that combining these categories would assist in the creation of themes. Categories were subsumed and combined by placing one envelope inside the other and then relabeling the outside of the envelope. For example, the category *Experiences* subsumed *How and When to Use* by folding and placing the *How and When to Use* envelope inside the *Experiences* envelope. The categories *Classroom Management*, *Behavior Management*, *Supplemental Material*, and *Diagnostic Tool* were combined to create a new category titled *Use*. This was done because all these categories contained codes that describe ways in which the participants perceive the use of DGBM. This process of concept mapping, subsuming, and combining reduced the number of codes from 19 to 9. The new categories were sorted on a tabletop again, which led to a first draft of themes. The initial themes can be seen in Figure 4.8 as a flow map indicating that these themes exist in a cause-and-effect relationship, where the combination of certain categories flow into another group of combined categories, etc.

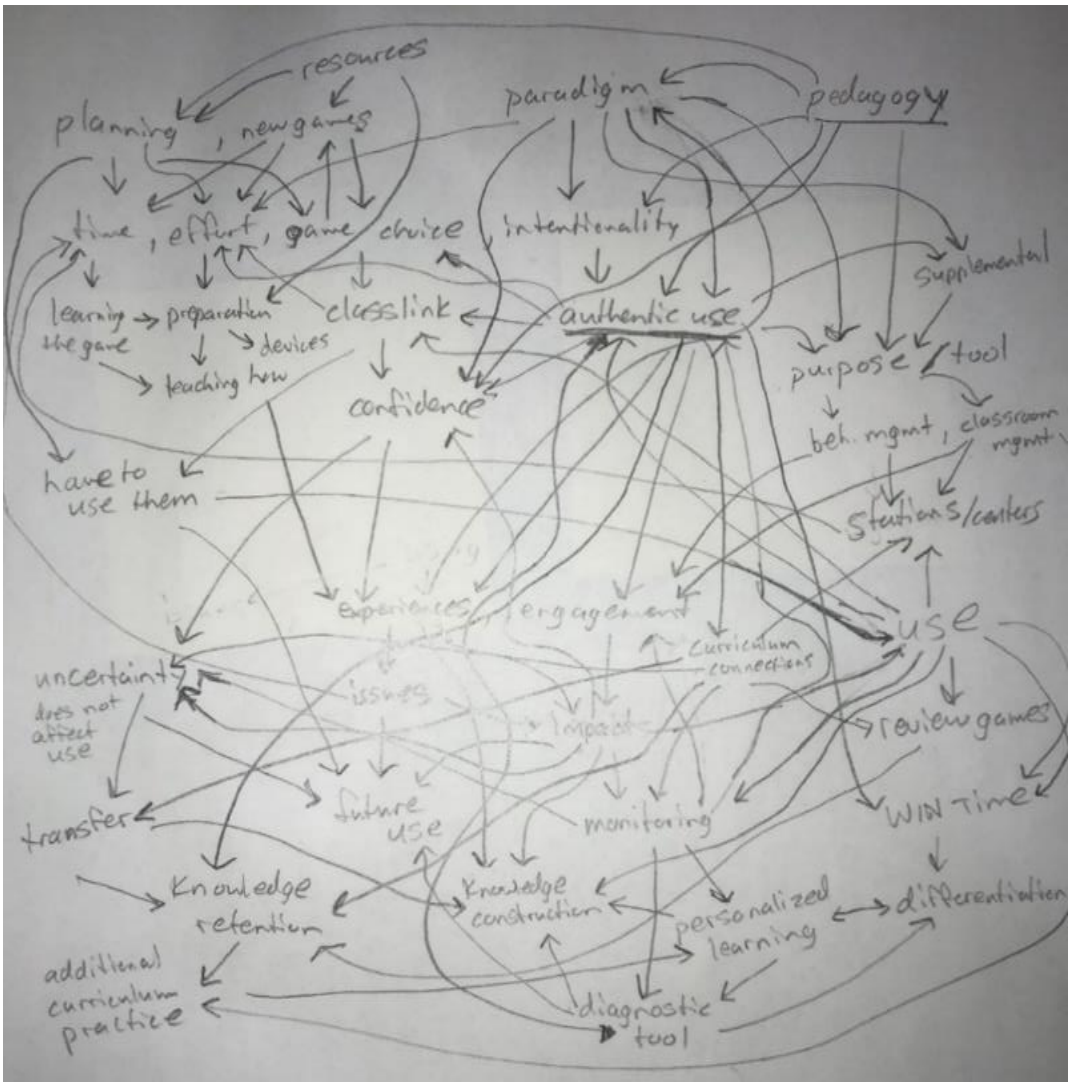

Figure 4.7 *Photograph of the concept map created to assist in theming the data.*

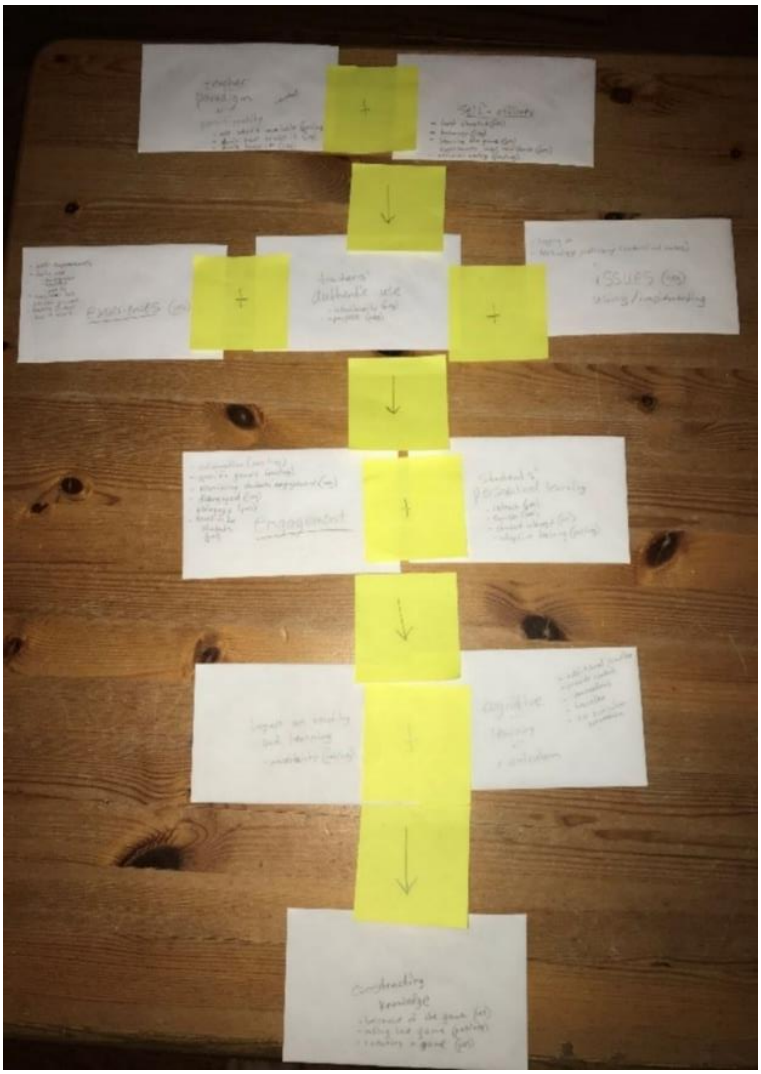

Figure 4.8 *Photograph of a flow map created with envelopes (categories) on a tabletop.*

After another session of peer debriefing, my dissertation chair recommended analyzing the codes differently so that the themes develop in a way that does not indicate a flow or cause-and-effect relationship. He suggested writing statements that describe how combined categories are suggesting an influential relationship on teachers' acceptance and use of DGBM, rather than trying to indicate a causal relationship amongst the themes themselves. A final analysis of the categories in this way led to the

development of three statements that will be used as final themes in this study's qualitative data analysis.

Findings and Interpretations

Qualitative findings were gained from nine individual teacher interviews. Pseudonyms were used to maintain the privacy of each participant' identity. Participants' perceptions are reflected in verbatim quotes and interpretations. After qualitative analysis, the following three themes emerged from the data: (a) teachers' beliefs and self-efficacy affect students' authentic use of and experiences with DGBM; (b) ease of use and engagement affects teachers' uses of DGBM; and (c) teachers' views of the independent learning opportunities and the curriculum connections in DGBM affects their acceptance of DGBM. Table 4.12 provides a summary of the themes, categories, subcategories, and examples of participant quotes used to create the theme.

Table 4.11 *Summary Table of Themes*

Themes	**Categories**	**Participant Quote**
Self-efficacy and issues with use influenced teachers' views about DGBM.	● Beliefs ● Self-efficacy ○ Comfortable ○ Trust ClassLink ○ Learning how to use it ● Authentic use ● Experiences ● Issues ○ Unanticipated ○ Access	● "I feel like I'm pretty comfortable being able to use them in my room." (Abbey) ● "I feel more comfortable using other resources." (Octavia) ● "I'm more of a just figure-it-out kind of person and just go through it and explore." (Katie)
Effort and engagement influenced the use	● Ease of use ○ Effort ○ Adaptive practice	● "I feel like the effort in the beginning can kind o be uphill." (Heather)

Themes	Categories	Participant Quote
of adaptive learning games.	● Engagement beliefs ○ Improves learning ○ Improves teaching ● Use ○ Supplemental tool ○ Classroom management	● "I really like the ones that are adaptive." (Angie) ● "Can they improve student learning? Yeah, definitely." (Pattie) ● "It enhances my ability to work with different groups." (Jessica)
Independent learning opportunities and curriculum connections influenced acceptance of DGBM.	● Curriculum Connections ● Learning Opportunities	● "If it's not aligned (with the standards), it can definitely be a distraction." (Kevin) ● "It can only really be useful if they can di it independently." (Abbey)

Theme 1: Self-efficacy and issues with use influenced teachers' views about DGBM

Theme 1 describes two influences on the types of digital game-based learning experiences teachers allow for their students. Teachers' beliefs about DGBM and their self-efficacy regarding using DGBM influenced the authenticity of the experiences they create for their students. Many participants in this study spoke about their beliefs that DGBM were not necessary teaching materials but expressed confidence in their ability to include them as materials in independent student activities. Individuals accept technologies according to their beliefs about the technology's usefulness (Davis, 1989). An individual's self-efficacy is deeply rooted in their beliefs regarding their personal ability to use technologies such as DGBM as well as their beliefs regarding available resources (Venkatesh & Bala, 2008). Also, teachers discussed issues that occurred when

students were using DGBM. Issues such as technical and organizational support, training, and previous experience have been found to be barriers that influence teachers' acceptance of digital games (Sánchez-Mena & Martí-Parreño, 2017). Theme 1 brings together five categories that outline how teachers expressed their (a) beliefs about DGBM, (b) self-efficacy using DGBM, (c) students' authentic experiences with DGBM, and (d) issues that occur when using DGMB.

Beliefs. Beliefs are a combination of values, attitudes, knowledge, experiences, opinions, prejudices, and perceptions about a concept or idea (Saldana, 2013). In this study, teachers acknowledged their beliefs about the importance of DGBM and the influence of personal gaming experience. The category *Beliefs* in Theme 1 subsumes the codes *DGBM are not a necessity, does not replace teaching*, *feeling like it's something extra to do*, as well as several structural codes related to teachers' personal gaming experience. Statements made by four participants expressed disbelief in the necessity and importance of DGBM. An example of this came from Abbey when she stated, "Do I have to (use them), is it a necessity? No." Abbey also expressed an understanding that DGBM did not replace teaching when she remarked, "I think it's great for kids and it's fun for them to be able to practice, but you never want it to take the place of good authentic in-person teaching." This belief that using DGBM does not take the place of teaching was supported by three other teachers, including Angie who stated, "I definitely don't overuse it. I don't use it as a, 'Okay just go do this' instead of teaching." Lastly, Heather's response confirmed her beliefs that DGBM were an extra, unrequired material. She said, "Sometimes it feels like that's something extra that you have to do. Since it's not necessarily totally required, you know, there's some components of like 21st century and

those kinds of skills but yeah, just feeling like it's something extra to do." These statements corroborated evidence found in other studies that tested the influence of beliefs on the use of technologies. General beliefs about a technology anchor an individual's self-efficacy (Venkatesh & Bala, 2008). If people do not believe a system to be useful, then they are unlikely to use it (Davis, 1989).

Participants' personal gaming beliefs and experiences did not affect acceptance of DGBM. Statements made by seven participants related to their personal gaming experience revealed a general lack of current gaming experience, although several participants reported playing video games in their youth. For example, when asked "Are you a gamer?", seven participants said, "No." Kevin stated, "Not a great one, but sure." Also, participants had mixed views on their general opinion of video games. Three participants said they like video games, but the rest of the teachers stated that they do not. It has been found that personal experience acts as a modifier of behavioral intention to use certain technologies (Venkatesh & Bala, 2008) and previous gaming experience was a significant influence on teachers' acceptance of educational video games (Sanchez-Mena & Parreno, 2017). Results of the current study disconfirm the literature regarding experience-related behavioral intention to use technologies.

Self-efficacy. Self-efficacy is a construct found to influence an individual's perceived effort regarding the use of a technological system, and can be defined as an "individuals' control beliefs regarding his or her personal ability to use a system" (Venkatesh & Bala, 2008, p. 278). Even though by definition *Beliefs* and *Self-efficacy* are relatable categories, they contain discernibly different value codes. Many of the codes subsumed by *Beliefs* were negative, whereas the codes subsumed by *Self-efficacy* were a

mix of positive and negative. *Self-efficacy* extends Theme 1 by providing examples of teachers' confidence in their ability to create digital game-based experiences for their students. Three codes are considered for this category: *comfortable, trust Classlink,* and *learning how to use it*. The text within these codes expresses self-efficacy beliefs provided by all nine participants.

Comfortable. Though statements vary slightly from teacher to teacher, many expressed having an average proficiency level and felt "fairly capable of doing … things even if I have to kind of sit there and go through it myself," as Jessica stated in her interview. When discussing her perceptions of using a DGBM, Brenda confidently remarked, "because of my experience, that will be something that will come easy to me." Other teachers voiced their self-efficacy beliefs using statements such as Katie who said, "I think I'm decently proficient" and Abbey who stated, "I feel like I'm pretty comfortable being able to use them in my room". Octavia's opposing opinion of her ability to use DGBM was given when she stated, "It just isn't something that I feel super comfortable with all the time. So, it's not my go to. Like, I feel more comfortable using other resources, like books and videos and stuff like that." Katie conveyed a similar opinion when she said, "It's really hard for me, user wise, to assign things. So it would just be, is it in the best interest of the kids or what are they getting out of it?" Teacher's comfort levels were also conveyed through their statements regarding school district approved DGBM.

Trust ClassLink. Teachers conveyed a high confidence level when using the DGBM available in ClassLink. ClassLink is a Single Sign-On (SSO) and repository of district approved web-based applications for teachers and students to use. During her

interview, Angie stated, “I feel like those are safe. They're in ClassLink, then they have been checked out by the district. I try not to stray too much from ones that I know are district approved. I feel like it's almost safer.” Similar opinions were expressed by other participants. Heather and Katie stated,

> Heather — I like the district approved ones because I'm trusting that you've vetted this website, you know that the privacy is okay. Like, nobody, no parent is going to be upset that I'm putting their kid on this website
>
> Katie — I think there's so many now issues with permissions and third party security and all that stuff that we kind of are just sticking to what the district is giving us because it's so many more steps to put anything in place that isn't already approved.

Participant remarks regarding how they learn how to use DGBM and how they teach their students how to use DGBM also highlight facets of self-efficacy.

Learning how to use it. Five participants in the study made confident remarks that conveyed a willingness and a desire to explore the game on their own when learning how to use DGBM. Katie, Kevin, Heather, Angie, and Pattie said,

> Katie — I’m more of a just figure-it-out kind of person and just go through it and explore.
>
> Kevin — I feel like (students’) user experience is kind of the most important because if I can see how it's teaching them, I can kind of assess the validity.
>
> Heather — I'm someone who's willing to, I'll look at it and I'll try it and I'll scope it out. Like I don't have a problem doing that.
>
> Angie — I need to make sure that I know what's coming, so I like to go through the lesson, the digital game. I like to play it myself first; make sure I know what's coming.
>
> Pattie — It makes me more comfortable too that I know exactly we're gonna go through ABCD, to get there.

These statements revealed that many teachers not only expressed confidence exploring a DGBM, but also conveyed that by doing so, their confidence was raised. Participants

made similar statements regarding teaching their students how to use DGBM. Kevin, Brenda, Katie, and Heather said,

Kevin	They're so familiar with digital interaction that they do better, just going in and exploring
Brenda	The best way to learn a new tech tool is to give the children the opportunity to play with that tech tool
Katie	I like to let them get on and just mess around
Heather	I like the ones better that they would just, they could figure out on their own; kind of go at your own pace.

Though some teachers spoke confidently about learning how to use DGBM, one teacher made self-doubting statements. Octavia remarked, “I think they would definitely both be more relevant if I actually got on there and signed in as a student” and “some of the newer ones like Dreambox and Reflex, like I'm learning as they're learning, or I'm learning after school how to use it.” Later in the interview, she said that to teach students how to use a DGBM, she would “just typically go for more of the small group setting because it's more easily accessible and I'm more accessible as far as help and I feel like they always have a deeper understanding of it after they leave a smaller group versus a whole group.” Octavia also stated that she would not use the assistance of another professional to teach her students how to use DGBM. She said, “I find myself just winging it and making it work. That's sometimes why I'm frustrated probably.” Other teachers expressed different views of the availability of human resources. Jessica said, “I would definitely kind of prefer, at least for the first time, to have somebody who knows what they're doing, kind of just assist (me) … so that I'm learning while teaching (the students).” The concept of self-efficacy has been a factor in many studies on technology acceptance. Researchers have found that self-efficacy was a determinant of perceived

ease of use, yet it does not have significant effects on perceived usefulness over and above factors driven by social influences and thought processes (Venkatesh & Bala, 2008). The findings in the current study extend the findings of other technology acceptance research, which suggests that teachers' confidence in their ability to create digital game-based experiences for their students (self-efficacy) is affected by their perceived ease of use of the DGBM.

Authentic use. *Authentic use* is the third category supporting Theme 1 and can be defined as using DGBM for authentic educational purposes. This category strengthens Theme 1 by reporting teachers' perceptions about the use of DGBM. *Authentic use* encompasses codes such as *intentional use*, *effective use*, and *place filler*. Since an individual's beliefs about a technology and his/her self-efficacy using the technology are moderators of use (Venkatesh & Bala, 2008), a closer examination of use is necessary. Participant statements presented in these codes evince use beliefs provided by six teachers. These statements for the most part were value coded *Negative*. For example, Octavia stated, "I think sometimes the frustrating thing is like, for certain ones, it feels just kind of like a space filler and like they're just on technology again, when it's like this generation is on technology all the time." In another example, Octavia spoke about the intentional use of DGBM:

> I do think they enhance teaching, if used correctly. And that goes back to what I was saying as far as just feeling like another thing that they're doing and that they're on. And I think if I or if teachers in general are more intentional about the integration, I think it's super helpful and impactful to your lesson.

Octavia's statement, "I think they're useful. I just don't think I use them all the time in a useful way" also reveals self-perceptions of the authenticity of her use. Other participants made similar remarks. Jessica, Heather, and Angie said,

Jessica	I can't tell you the first thing that's on (Reflex) right, they just get on and they start playing.
Heather	I do use it as like this kind of extra practice independent work, kind of just place filler.
Angie	Starfall is a great activity. So I don't see any progress from them being on it but they can sit and work on some letters, if I'm doing something else because they've got to know their letters.

Other participants made differing remarks about the use of DGBM, including Brenda who claimed, "I think that done effectively that digital game-based learning is a very useful tool in the classroom" and Pattie who said, "I don't like to feel like I'm using them as a babysitter, to be honest with you, just a filler." These statements contained the value code *Positive* because of the apparent educational purposes behind the digital game-based experiences. In one instance, though, a participant made seemingly contradictory remarks about the authentic use of DGBM. Kevin said, "When it's appropriate, it's very useful because it helps increase the student engagement on your topic." However, in another part of the interview, he said that he allowed his students to use DGBM after they completed their morning routine. He stated, "So it's, it is a reward for 'Hey, you're here. Now you get your stuff done. Awesome, faster you do that more time you get.'" These quotes mean teachers have differing views on why DGBM are used in their classroom. Some teachers use them as a "place filler", as Heather stated. Other teachers use them to increase student engagement in concepts being taught. Along with illustrating teachers' authentic use of DGBM, the current study developed the category *Experiences* to further expand Theme 1.

Experiences. Experiences are the "exercises and games used to involve students in the learning process (Kolb & Kolb, 2009). The category *Experiences* further defines Theme 1 because teachers create and control situations and activities where students are

using DGBM. Therefore, their beliefs and self-efficacy play a part in the experiences they create. The codes s*tations*, w*hole class review*, and *morning work/routines* comprise this category. Eight teachers interviewed made statements regarding various experiences they have allowed for their students. These statements were value coded both *Positive* and *Negative*. Many statements made by participants claimed they use DGBM as a station activity. Independent stations allow the classroom teacher to work with a small group of students while the rest of the class engages in small group activities. Teachers said,

Jessica	Most of the use for us is going to be always in you know center work or where one you know, like in small groups where three people can sit with one tablet or something like that.
Angie	They are generally going to be in, in small groups. Yes, using them while I'm pulling groups.
Octavia	Sometimes it's like, it'd been like a station. I think that's constantly what I'm doing. So I'm just like throwing, like, 'Yeah, go on to Dreambox' and like, 'Go on to Reflex' and it's just like, continuously like, 'Go on these things'.

Teachers also stated that whole class review games were experiences they create using DGBM. For example, Pattie described using DGBM with "science and social studies for just like the review aspect of it. Prepping for a test, you know, with the Kahoot, and the Gimkit, and the Quizizz. Those kinds of things." Jessica also described using DGBM "like Quizizz or Kahoot. Yeah, where they come, you know, to the carpet, and you have X amount of (devices), and they sit in a small group and answer." Kevin was the only participant to make statements regarding using DGBM in the morning. He said, "The morning is probably another, like they're usually excited to come in and grab their Chromebook and that's like, you know, 'Here's your free time.' But, you know, it's constructed free time." Later in the interview, Kevin brought up the subject again and stated, "I think it's, it's nice to have something that helps push them through their morning

routine. ‘Get unpacked, get your choices made and get your homework turned in, and then get to playing.’” Even though Kevin’s statements reflected a desire to use DGBM as a motivator, during another part of the interview Kevin talked about being frustrated when his students missed the opportunity to gain more content knowledge. He said,

> You know, it's, it's frustrating to me when the students don't even get to, like if I have a student that comes in super late and they don't even get to it, then they've, they've missed out on the material that I have assigned within it. And so it's frustrating to see them — Well, number one you didn't get to play so you missed out on the fun, but number two, like you missed out on the content. You know, this would have been a great time for you to be able to practice this.

These quotes mean teachers are using DGBM as a station activity, a whole class review activity, or as an incentive for completing their morning routine.

Researchers Venkatesh and Bala (2008) found that experience influenced an individual’s intent to use technologies. These researchers suggested that once an individual gained experience using a technology, the effect of effort (perceived ease of use) on his/her intent to use the technology would decrease because the individual will have gained more knowledge about how to use the technology. Research on the authenticity of use, as described by participants of the current study, is lacking. However, studies show that simulations and virtual reality games can provide authentic learning tasks in the classroom (Honey & Hilton, 2011; Kitchen, 2022; Vogel et al., 2006).

Issues. Issues could be problems or difficulties that were unexpected and could cause disruptions with DGBM use. *Issues* is a category subsumed by Theme 1 because issues can occur during experiences teachers create for their students and these issues can influence the teacher’s beliefs about, and self-efficacy regarding, DGBM. *Issues* is a synthesis of codes *unanticipated issues* and *access*.

Unanticipated issues. Four participants reported unanticipated issues related to students' inability to solve problems on their own, which were value coded *Negative*. When Angie was asked to describe her opinion of her ability to help students if issues arise, her response was, "Not real good." She also stated, "I feel like I can teach them how to use it, but when very specific questions come up, I'm not good at answering those questions." Pattie said that unanticipated issues with the DGBM can cause her to doubt herself. She said, "I think the program itself would cause the doubt, just if it's not running smoothly for me, and I can't figure out how to navigate it, and it's a disaster when you try it with the kids." Octavia expressed concerns about having control when issues arise. She said,

> It's like control. When I have more control. I feel more comfortable. Sometimes I feel like with technology and especially with like helping them troubleshoot, there's less control that I have because it's, I'm learning or it's new to me too, or I don't understand it. So then that's when I start to get like a little frustrated or just like a little like anxious because I'm like, I don't know either.

Later in the interview, Octavia expressed those unanticipated issues may cause doubt in her ability to use DGBM. Her response was, "I think that's the biggest thing honestly. Is like that is truthfully what like stops me from doing more." Other participants also expressed concerns about being able to help students resolve issues. Heather and Pattie said,

Heather	If everybody is working on something, and I'm at the front, and then one person asks, and then that holds everybody else up. I think those are the times when, like, if just one kid isn't getting what's going on with it. So I think that's why I just like the self-paced ones a little better because I just, when the students are engaged, things go well and when they're having to wait, especially if it was something that I was like, 'I don't know how to do this', then that's, I think, what makes me nervous about it.
Pattie	Those things I find frustrating for myself when, you know, they come to me and I haven't been able to figure out what they're

> talking about or even go back later on and replicate what they're talking about, without actually having to sit there with them and go through it. And when you got 23 kids, you know, then you have 22 that are doing something else at the same time.

These statements together say that teachers have concerns about controlling behavior while trying to help students resolve issues. Other statements in *unanticipated issues* had *Positive* value codes. For example, Abbey stated, "I feel very confident that I'd be able to do that (help students if issues arise) because again I only show them the ones that I've taken the time to familiarize myself with the most." Contrary to Octavia's statement about doubt, Kevin stated, "I wouldn't say personal doubt, no, but just an awareness of, you know, this problem may arise so watch out for it." Along with unexpected issues, participants said problems accessing the DGBM were additional concerns.

Access. Not having enough devices and students' technology proficiency, especially with logging in, were problems expressed by many participants in the study. The issue of not having enough devices was a concern expressed by several participants. For example, Jessica said, "Having only 14 pieces of technology and 20 students, … I'm either going to have to do it only in the time where I could do centers, or you know, where I can use one piece of technology for multiple students." Katie also expressed a desire to have more devices when she stated, "We currently are about three-to-one for devices. So we need to have, I would ideally like to have one-to-one, but at least two-to-one." Heather expressed the same opinion with utilizing DGBM when she said one issue she experiences is "not having one-to-one and just trying to use them in a fair way."

Issues with students' technology proficiency, especially with logging in, was expressed by six participants. Some teachers shared detailed accounts of issues they have

seen with their students trying to access the DGBM. For example, Katie, Pattie, Octavia, Angie, and Heather stated:

> Katie — Um, not, them not signing out correctly and kids getting on other kids accounts. So if they all, they're supposed to click their name, a lot of times they won't log out and they don't have the wherewithal to see that their name is not at the bottom. So they're just playing somebody else's assignments or somebody else's games.
>
> Pattie — I hate to take up a lot of class time dealing with those kinds of things, just, you got three kids logged on, or ready to go and 10 that are waiting and have hands in the air, trying to make it as efficient as possible so that we can actually get to the meat of the instruction. What we're trying to do rather than the hurdles with getting signed on.
>
> Octavia — I have students that get really anxious about logging in, and it is just very rough and very hard and very difficult and it causes quite a lot of just like frustration and there's like a big anxiety to it.
>
> Angie — Usually in the beginning, the hardest part is just teaching them how to log in and sign out.
>
> Heather — This is I don't know, the seventh or eighth week of school and it feels like now they're finally able to log in fast enough to actually use it.

Not all the participants shared the same concerns about their students having problems with accessing the DGBM. Kevin said,

> For the most part, these guys are familiar enough with it (logging in), that they are, and I have had classes where the maturity level and experience isn't that great and they would need, like, board demonstration of how to do it, but for the most part these guys wouldn't need it.

Teachers' remarks together expressed issues they experience when utilizing DGBM, such as students' inability to problem solve, lacking enough devices in the classroom, and students' technology proficiency levels.

Many of the issues reported by participants were expressed through experiences they described during the interview. As stated earlier, experience is a variable of

technology acceptance that has been studied significantly in the past. Though research on students' experiences with technological issues and the effects of those issues on the use of DGBM is lacking, research on technology proficiency and computer self-efficacy does provide some connections to acceptance and use of DGBM. Computer self-efficacy can be described as an individual's perceived ability to complete a task using a computer (Hung, Sun, & Yu, 2015, p. 176). Researchers have found that computer self-efficacy has a positive influence on students' learning outcomes (Bates & Khasawneh, 2007). Issues related to students' technology proficiency, especially regarding accessing the DGBM, can be influenced by their computer self-efficacy.

Theme 2: Effort and engagement influenced the use of adaptive learning games

Theme 2 describes two influences on participants' use of DGBM: ease of use and engagement. The findings in Theme 2 express teachers' opinions about the effort (ease of use) required to create personalized learning opportunities for students. Teachers also expressed beliefs about the engagement aspect of digital games. Three categories will be used to convey teachers' perceptions about the effort it takes to create digital game-based activities and how perceptions of student engagement affect the way DGBM are used in the classroom: (a) E*ase of Use*, (b) E*ngagement Beliefs*, and (c) U*se*.

Ease of use. Ease of use can be defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320). The creation of the category *Ease of Use* was guided by subcategories *effort* and *adaptive practice*. Teachers in the study spoke of the effort they spend planning and preparing DGBM for student use. Many teachers also made statements regarding the ease of utilizing the

adaptive learning aspects of DGBM, thereby decreasing their overall effort of implementing DGBM.

Effort. The code *effort* includes teacher statements about expected time and energy needed to implement DGBM in the classroom. Expected effort has been shown to be a strong determinant of an individuals' intent to use a technological system (Sánchez-Mena & Martí-Parreño, 2017; Venkatesh et al., 2003). In the interviews, teachers discussed the importance of time and energy, and how those factors influenced decisions regarding DGBM. Katie expressed that the ease of creating personalized assignments was important. She stated, "So if it is easy to personalize where it is not cumbersome to like individually go in and do things like that. That's definitely something I'm always interested in." Jessica also spoke about the relationship between effort and time. She said,

> I guess if I had something and I found it, and I tried to use it, and I, you know, couldn't get it together, and I couldn't get somebody to come in, or whatever. And then I probably would not, again, back to time, at some point I'd go, never mind…the effort is way too high, you know. You want to be able to find it and do it. And, you know it's helpful. But not, not where the amount of time to, you know, if the front end is too time consuming.

Heather also expressed a concern about time and effort when she stated, "The reason I stick to the ones I know and I'm familiar with it probably is … feeling like it might take a little bit of time and effort (to find new games) and I don't know if it's going to be worth it in the end." Some participants expressed that DGBM were less easy to use at the beginning of implementation. Brenda stated, "As far as the overall effort, I do think that in the beginning that it would take a lot of planning." Heather said, "I feel like the effort in the beginning can kind of be uphill like when you're learning to use a new one." Participant statements about their overall effort and the influence it has on use generally conveyed mixed feelings. Jessica said, "The effort required is worthwhile for the

positives that come from it," and Angie stated, "I definitely think it's worth the overall effort." Heather said, "really like the time that it also saves me." However, other participants had different opinions. When asked if DGBM was worth the effort, some teachers expressed that it depended on the material. Pattie said, "Yeah, I think so. I think it really depends on what the program is to be honest with you." Octavia stated, "I think when the program's really helpful, and I think when it, like I can see progress from them using it, (then) it's definitely worth the effort." These statements together expressed effort can be high at first but using DGBM was worth the overall effort.

Adaptive practice. In the study, participants remarked multiple times about the ease of using DGBM because of the adaptive assignments the material would generate for the user. The term adaptive refers to the capability of the DGBM to use data and analytics to evaluate students' skills and create "appropriate pathways and priorities for each student" (New Media Consortium, 2014). Five participants made statements regarding the adaptive learning aspects of the DGBM they use. For many participants in the study, the capability of a DGBM to adapt to the learner was found to be important. Teachers said:

Octavia	It just kind of helps me hit, or like, at least feel like it helped me feel a little bit better that they're getting a little bit more too from somewhere else. Like I'm helping them, they're getting it from this adaptive thing.
Angie	I really like the ones that are adaptive, not where you only have to choose a skill level. So when there's a quick, quick and easy pretest, and then (the student) just starts working from there. So the adaptability of the game makes it.
Heather	It's just a nice blanket way that I can say like, I know that at least, at one point during the day I'm meeting a lot of different kids' needs.

Participants also expressed beliefs that adaptive games were useful for differentiation and meeting the needs of all their students. For example, Heather stated, “If it's just supplemental or something that is for differentiation or enrichment, then I like to use a lot of the kind of the ones that assess where they are and then meet them at their level.” Another example was when Jessica said, “It allows for so much differentiation. Many of the things that we are using are adaptive or you can set up levels, if they're not adapted.” Kevin expressed that most DGBM “are designed to be out of the teachers’ hands anyway. They're interactive and they're adaptive and they kind of direct students down a certain path.” The adaptive learning aspect of some DGBM raised concerns from one participant. Pattie expressed uncertainty regarding the accurate levels some students were placed on by the DGBM. She expressed that a DGBM may decrease her teaching ability “if the program is not quite correct on where it's putting kids and what they're being taught through the program.” Later in the interview, she returned to this idea when she considered how DGBM may decrease student learning. Pattie said,

> When they're, I don't know, sometimes you just wonder how they target certain things, you know … This child is, according to their Star data, ready for adding and subtracting fractions. No, they're really not. And all it's doing is creating a lot of confusion and frustration for them. Like, ‘I don't understand this’ (or) ‘I don't know what they want me to do.’ You know, you as a teacher do not have the time to go around and individually teach every child, you know, what a program may be presenting them. So that's where I think it starts to become a time filler or time waster for the kids at that point.

Ease of Use reports teachers’ statements about the effort related to using DGBM and the adaptive learning aspects of DGBM. Learners’ abilities and skills are important and digital games need to be adaptive to the needs of the learner (Vasalou et al., 2017). The ease in which DGBM can create adaptive learning experiences was important to teachers’ perceived ease of use.

Engagement beliefs. Engagement can be defined as "the willingness to have emotions, affect, and thoughts directed toward and aroused by the mediated activity in order to achieve a specific objective" (Bouvier, Lavoué, & Sehaba, 2014, p. 496). During the interview, participants expressed beliefs about engagement relative to the capability of DGBM to improve teaching and learning by increasing student engagement. *Engagement Beliefs* subsumes the codes *improves learning* and *improves teaching*.

Improves learning. Teachers' perceptions about the potential of DGBM to improve student learning were conveyed in statements made by five participants. These teachers expressed beliefs that DGBM can improve their student's learning. Previous research confirms DGBM can have a positive effect on students' achievement (Clark et al., 2016; Hwa, 2018; Ke, 2009). Together, Katie, Pattie, Octavia, Kevin, and Brenda expressed a belief that the use of DGBM in their classroom increased student learning. These teachers said,

Katie	It's something that is more interesting for them instead of sitting whole group on the carpet.
Pattie	Can they improve student learning? Yeah, definitely. (Pattie)
Octavia	I can think right now, (for) a lot of kids (it) would be very significant. Like, they would learn a lot better through that game than they would through anything else that I'm doing.
Kevin	If they're doing a sheet of problems it's boring, but if they're doing this game-based learning, they'll engage for a lot longer to repeat the same task and have it become something that's just easy for him.
Brenda	They definitely engage the students. I feel like engagement is one of the most important parts because if the students buy in and they're having fun, they're going to want to do it.

Three participants expressed a concern about student engagement. Kevin, Octavia, and Angie spoke about disengagement with DGBM. They said,

Kevin — Some (issues are) like not actually being engaged and doing what they're supposed to be doing. So, they sit in front of the screen and don't move on to the next element, or, you know, decide this one's too hard and they're just going to be done with it.

Octavia — They don't want to do it because, purely because it's math review and I think some of them are just, like they are just used to click, like they just click. They're just, I think some of them have outsmarted me a little bit. And they know that I think that there's no way that I'm going to check that, or that I am checking that. And so they are just kind of just clicking.

Angie — I have some that just like to sit there, just click buttons, they're not looking, they're not reading they're not listening. They're just clicking buttons.

Octavia's statements above also suggest connections between disengagement and the teacher's active monitoring of students during the use of DGBM.

Improves teaching. As noted previously, ample research indicates digital games can have a positive effect on students' achievement. However, a lack of relevant research exists regarding the impact on teaching. Two teachers expressed that they believe increased engagement caused by DGBM can improve their teaching. Abbey and Brenda said,

Abbey — I do think (DGBM) improve (teaching) because they just make it, they can help make it more fun and more relevant for kids.

Brenda — I think that a big part of it is that the students buy into it, the student engagement, and teachers feed off of that. You feed off the energy of your crowd, so if my students are buying into it then, I feel like that makes me personally more competent, that drives my competence and the teaching, so I think that that makes me a better teacher.

Not all teachers expressed the same beliefs. Katie and Pattie disagreed with their coworkers when they stated,

Katie — I don't think it improves my teaching.

Pattie I don't know if they improve my teaching or just improve the student learning.

Participants' statements regarding any perceived improvement in teaching was based on their opinion that improved engagement increases student learning.

Increased engagement caused by DGBM can create changes in teaching and learning in participants' classrooms. This is substantiated in past research studies on engagement. Engagement has been identified as a mediator on the achievement of a specific objective, but it has depended on both the game-based activity and the player's expectations before, during, and after playing the game (Bouvier et al., 2014). Interest and engagement in games have had positive effects on learning outcomes when students possessed the motivation to learn new knowledge in the game (Hamari et al., 2016; Tsai et al., 2012). Improvements in student learning can occur because of using DGBM, if students are engaged.

Use. An individual's use of a technology is affected by acceptance, which is mediated by many variables including ease of use and self-efficacy (Davis, 1989; Venkatesh & Bala, 2008; Venkatesh & Davis, 2000; Venkatesh et al., 2003). By examining participants' use beliefs, relationships among all three categories in Theme 2 are advanced. Participants' descriptions about how, when, and why they use DGBM relates to categories *Engagement Belief* and *Ease of Use*. Use was described as the utilization of DGBM during school activities for a specific purpose. The latter part of that definition is further explained with the codes by which the category *Use* was created: *supplemental tool* and *classroom management tool*.

Supplemental tool. The code *supplemental tool* contains participant statements regarding DGBM as an educational resource that has value but is not a necessary

material. Three participants stated that DGBM were supplemental. Katie stated, “It's more of a tool. I don't think it's something that affects that much of what I'm doing.” When lesson planning, Angie and Kevin perceive DGBM as an extra resource. They said,

> Angie — I love that they're around because it definitely adds an element of fun and element of just a new resource, and we're always looking for more resources. So, a resource is right there that doesn't take any time to prepare.
>
> Kevin — I mean just giving me one more resource that I can use; one more tool in my toolkit.

The statements within *supplemental tool* bares resemblance to statements within *classroom management* because both describe perceptions teachers have about the use of DGBM.

Classroom management. The code *classroom management* contains participant statements regarding DGBM as a classroom management tool used to create opportunities for guided small group instruction. Three participants spoke about the circumstances DGBM can create in their classroom. Jessica, Katie, and Angie said,

> Jessica — It enhances my ability to work with different groups.
>
> Katie — I think it improves my classroom management, scheduling, and ability to pull small groups because it's giving them a tool to be occupied while I'm pulling small groups.
>
> Angie — I do use them for remediation so some of our really lowest ones, if I'm doing something that, I have a few that, I mean they, they can't and I don't mean that in a bad way, they are going to be zoned out coloring. They're not going to be paying attention because they cannot, they don't know letters they don't know sounds, they can't, so, I will, I will put them on iPads to work on letters and sounds while I teach something to this group, and then I can go work with them individually. It’s a great use for that.

The code *classroom management* also contains statements from three participants regarding the use of DGBM to help manage students. For example, when Jessica was

asked in what other ways besides increasing engagement do DGBM improve student learning, her response was, “(I) think that's kind of the main things, right? Engagement and motivation. Them wanting to use it. Using it as a behavior regulating tool too.” Other teachers also made remarks about using DGBM to motivate students. Pattie, Kevin, and Katie said,

Pattie	They're not going to perceive a digital game, the same way as if I handed them a math sheet with 100 facts on it, you know. They'll do 100 facts on Reflex without even really realizing it. But if you give it to them paper pencil then they shut down.
Kevin	I have used prodigy as a reward. ‘So you guys have done a great job and you know you've, you've earned an extra 20 minutes of prodigy today’.
Katie	I think that helps with engagement. They are more likely to finish something when they know it's on the iPad.

The category *Use* describes teachers views on how DGBM are used in their classrooms. This category relates to *engagement beliefs* because teachers believed the engaging aspect of video games can motivate learners and keep them engaged while teachers work with small groups of students.

Connections can be made between Theme 1 and Theme 2 because ease of use has been shown to influence self-efficacy (He et al., 2018) and behavioral intention to use educational video games (Sánchez-Mena et al., 2019). Relevant research further corroborates the findings in Theme 2. Effort influences self-efficacy and is an indirect cause of the intention to use a technology (Venkatesh & Davis, 2000). Along with teaching and reinforcing concepts, increasing engagement and motivation have been viewed as strong reasons to use digital games in the classroom (Sanchez et al., 2016). Venkatesh and Davis (2000) found that when teachers were given a choice of multiple relevant systems, they have been inclined to choose the system that gave them the highest

output quality. This statement could also hold true when teachers choose to use DGBM over other classroom materials.

Theme 3: Independent learning opportunities and curriculum connections influenced acceptance of DGBM

Theme 3 describes two influences on teachers' acceptance of DGBM: (a) the degree to which the game can connect to the classroom curriculum and (b) the game's capability to provide independent learning opportunities for reteaching and/or enrichment of the curriculum. This theme, like Themes 1 and 2, describes influences on teachers' acceptance of DGBM. In contrast to Themes 1 and 2, Theme 3 centers on the capability of DGBM to provide students with independent activities that reteach or enrich the elementary curriculum, particularly the mathematics curriculum over the English/language Arts (ELA) curriculum. Over the past two decades, studies on the use of digital games in mathematics education have dramatically increased (Byun & Joung, 2018). In a study on the use of digital games as a tool in mathematics learning for primary school children, Hwa (2018) concluded that by enhancing traditional teaching methods with digital games, students' performance in mathematics was improved. However, there is a dearth of relevant research examining the effects of digital game use to enhance the ELA curriculum in elementary education. Theme 3 brings together two categories that outline how teachers expressed their (a) observations of the curriculum connections in DGBM and (b) views about the level of independence that occurs when students are using DGMB.

Curriculum connections. The term *curriculum connections* describes how the academic skills within the game connect to curriculum standards set forth by the

Wisconsin Department of Education. In the study, teachers' statements represented the relevance of DGBM to the curriculum and the extent to which relevance influenced their acceptance of DGBM. Four teachers expressed that DGBM were relevant when the skills in the game are aligned with the curriculum. Heather, Katie, Angie, and Kevin said,

Heather	They're very relevant, and how I'm thinking about that word is, you know, are they hitting the standards and things, learning targets that I'm working on? And I try, I don't really want to use any that I don't think are relevant.
Katie	I can look exactly what standard we're working on and assign that specific skill to either the whole group or certain kids who are working on that skill.
Angie	I like that there's a direct link to what we're teaching and then what they're doing when they're sitting on the floor (playing a game).
Kevin	If it's not aligned (with the standards), it can definitely be a distraction.

Teachers commented that connecting the DGBM to their instruction was an important aspect of the DGBM they implement. Five teachers remarked that many curricular connections can be made with mathematics. Jessica, Abbey, Heather, Angie, and Pattie said,

Jessica	I feel like it definitely gives them an opportunity for more experiences with (the math curriculum).
Abbey	With math, I find that it can be super effective.
Heather	I mostly use it for math.
Angie	Math seems to be the leader. There's so much math content out there.
Pattie	It's just easy with math because it's just so skill oriented.

Teachers also expressed views on the capability of DGBM to reteach and enrich the English/Language Arts (ELA) curriculum. Two participants described DGBM as irrelevant for reinforcing ELA skills. Pattie and Jessica said,

Pattie	There doesn't seem to be as much out there for the ELA, as there is for math skills. Math is very skill oriented so you can easily develop programs and things to test and assess that and teach kids that.
Jessica	Reading is just reading on technology. It's not gaming for reading.

Together, participants in the study expressed that the skill and drill aspect of many digital games lent itself to practicing math skills over ELA skills, although Pattie expressed that she may not have yet found any ELA-based DGBM. She said, "The ELA does not seem to, or I haven't found it yet – let's put it that way – have that wealth of gaming material for the kids." Not all the participants agreed, however. Octavia stated that "as far as actually supporting the curriculum, it doesn't always feel like it's super relevant to, like, during the actual implementation of the lesson." Generally, the participants in the study reflected that the curriculum relevance of DGBM positively influenced use.

An examination of relevant literature revealed confirming studies that have examined the curricular connections between digital game content and curriculum and how those connections influenced teacher acceptance of DGBM. De Grove et al. (2012) found that if digital games were perceived as connecting to the curriculum, they would also be seen as useful tools that could extend learning opportunities in the classroom, which in turn could positively influence teachers' use of the technology. The findings of another study suggested that the adoption of educational video games was influenced by how the game connects to the curriculum (Rocha, Tangney, & Dondio, 2018).

Learning opportunities. The category *learning opportunities* in Theme 3 can be described as the capability of the DGBM to provide independent learning activities where the game was reteaching or enriching the curriculum. *Learning opportunities* is distinguished from *curriculum connections* by presenting teachers' statements regarding

the usefulness of DGBM to independently reteach and enrich the curriculum, as well as the transferability of knowledge gained from playing the game. In this study, teachers acknowledged that independence was an important aspect that increases the usefulness of the DGBM. For example, Abbey said, “It can only really be useful if they can do it independently.” Other teachers agreed. One characteristic Olivia found important was “the usability of it. Like whether they can be independent on it or not. So, like if it’s easy for students of this age to have success.” One teacher expressed concerns about her students sometimes not using DGBM on an independent level. Katie said, “If it's taking us to oversee the activity, I would not pick a digital game-based activity.” Many participants expressed that the usefulness of DGBM was influenced by the degree to which the learner was independently engaged. Some teachers also said the capability of the DGBM to reteach the curriculum makes the game useful. Octavia, Abbey, Angie, and Pattie said,

Octavia	If they didn't quite understand (the lesson), it's another way to give them the material or to present them the material.
Abbey	If I'm teaching it for a few days and I'm not seeing they're making as much progress as I'd like, then that would encourage me to go look a little bit more to try to find something game-based or digital just to show them a different way.
Angie	I think probably if I, if there's a skill that we're just having a hard time mastering, then I can use that as a reteach method. So, ‘Okay, I tried it this way and I tried it this way. Let's try another way and just see if that can get through’.
Pattie	It can help with getting them to that mastery point of a concept or skill.

Along with remediation, Kevin expressed that DGBM can “help increase the depth to which they're learning (a topic), and so I feel like the more activities that you can do with a topic, the better off they'll be because they've experienced it in greater depth and

breadth." Participants similarly remarked about the importance of transferring knowledge gained from the game into practical application. Abbey remarked, "If I saw it working, kids being engaged, kids improving performance and having a transfer to their common assessments, all those things, all those things would encourage me to want to use that more." Kevin stated he liked reviewing the game analytics and "seeing what they're working on there and then seeing like… the gains that they're making inside the classroom and…the better grades." Teachers found DGBM useful if students used the material without much assistance and if they believed their students were transferring the academic knowledge gained in the game to formal and informal assessments.

Perceptions about remediation and enrichment opportunities provided by digital games has been published in a few studies, but research on the effects of independence and transfer is lacking. Hwa (2018) stated that digital games can provide remediation opportunities because the game "takes on the role of a very patient private tutor who is willing to repeat countless times per the learners' needs" (p. 272). In a paper describing the importance of digital game-based learning, the authors expressed that playing simulations and games can provide students with enrichment opportunities that promote the application of higher-order thinking skills (McNulty et al., n.d.).

Chapter Summary

To summarize, Chapter 4 discussed how perceptions and experiences inform the acceptance of digital game-based materials for K-5 teachers at Hill Street Elementary School. Survey data presented descriptive statistics to summarize and describe how perceived ease of use, perceived usefulness, perceived relevance, self-efficacy beliefs, and past experiences inform teachers' acceptance of digital game-based educational

materials. Teachers' high agreement with statements of perceived self-efficacy (M = 4.04, SD = 0.98) and perceived ease of use (M = 4.01, SD = 0.99) were shown to be the most influential on DGBM acceptance. Perceived usefulness (M = 3.79, SD = 0.98) and perceived relevance (M = 3.70, SD = 1.04) were shown to moderately influence acceptance. Lastly, experience (M = 2.10, SD = 1.06) was the least influential construct tested in the study. Analysis of interview transcripts identified three themes: (1) Teachers' beliefs and self-efficacy affect students' authentic use of and experiences with DGBM; (2) Ease of use and engagement affects teachers' uses of DGBM; and (3) Teachers' views of the independent learning opportunities and the curriculum connections in DGBM affects their acceptance of DGBM.

Nine individual teacher interviews disclosed how teachers' beliefs and self-efficacy affect students' authentic use of and experiences with DGBM. As discussed in Theme 1, participants in this study expressed beliefs that DGBM are not necessary teaching materials but made confident remarks regarding their ability to include them as materials in independent student activities. Participants also spoke confidently about exploring DGBM and teaching their students how to use them. Theme 1 also showed that teachers have differing views on why DGBM are used in their classroom. Some teachers use them as extra practice and other teachers use them to increase engagement. Theme 1 revealed that teachers are using DGBM as a station activity, a whole class review activity, or as an incentive for completing their morning routine. Finally, participant statements quoted in Theme 1 described access issues such as logging in and other unanticipated difficulties. These issues together stated that teachers have concerns about controlling behavior while trying to help students resolve problems.

Theme 2 highlighted participant opinions about the ease of using DGBM. Teachers in the study expressed the effort of using DGBM can be high at first, but overall using DGBM was easy and worth the effort. They also said that adaptive games were easy to use and can aid with differentiation. However, the participants reported mixed views on the benefits of increased student engagement because of DGBM, such as improvements in teaching and learning. Lastly, participants described how, when, and why they use DGBM, which included use as a supplemental material and an instrument to ease classroom management.

Theme 3 uncovered teachers' views of the independent learning opportunities and the curriculum connections DGBM provided, in addition to how those opportunities and connections affected their acceptance of DGBM. Generally, the participants in the study reflected that the curriculum relevance of DGBM positively influenced use and DGBM were useful when students were independently and actively learning. Teachers also expressed that DGBM were useful when their students were transferring the academic knowledge gained in the game to formal and informal assessments in the classroom, particularly with the mathematics curriculum over the English/language Arts (ELA) curriculum.

CHAPTER 5: DISCUSSION, IMPLICATIONS, LIMITATIONS, AND CONCLUSION

The purpose of this research study was to explore ease of use, usefulness, relevance, self-efficacy, and past experiences to describe influences on elementary teachers' acceptance of digital game-based materials. The questions this study intended to answer were (1) How, and to what extent, does ease of use influence teacher acceptance of digital game-based educational materials; (2) How, and to what extent, does self-efficacy influence teacher acceptance of digital game-based educational materials; (3) How, and to what extent, does usefulness influence teacher acceptance of digital game-based educational materials; (4) How, and to what extent, does relevance influence teacher acceptance of digital game-based educational materials; (5) How, and to what extent, does experience influence teacher acceptance of digital game-based educational materials? The answers to these questions are presented in this chapter through an integration of relevant research, qualitative data from teacher interviews, and quantitative data from the survey to present the (a) discussion, (b) implications, and (c) limitations of the research study.

Discussion

A descriptive exploration of five research questions has yielded quantitative and qualitative results. There are many acceptance factors that might influence teachers' intent to create instruction supplemented or enhanced with digital game-based materials.

The current study used a conceptual framework based on editions of the Technology Acceptance Model (Davis, 1989; Venkatesh & Bala, 2008; Venkatesh & Davis, 2000). This framework was created for the purpose of describing how perceptions and experiences inform the acceptance of digital game-based educational materials. The remainder of this section will integrate relevant literature and study findings to discuss how, and to what extent, teachers' (a) perceived ease of use, (b) perceived usefulness, (c) relevance, (d) self-efficacy, and (e) experience influences their acceptance of digital game-based materials.

Research Question 1: How, and to what extent, does ease of use influence teacher acceptance of digital game-based educational materials?

Ease of use can be defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320). Perceived ease of use has been shown to positively influence individuals' acceptance of educational digital games (Cheng et al., 2013) and intentions to use technologies (Davis, Bagozzi, & Warshaw, 1989; Sánchez-Mena & Martí-Parreño, 2017; Venkatesh et al., 2003). Teachers at HSES who completed the survey corroborated this research, agreeing that perceived ease of use was an influential determinant of acceptance (M = 4.01, SD = 0.99). Though opposing views existed, teachers found that DGBM were worth the time and effort they put into it. Jessica stated, "The effort required is worthwhile for the positives that come from it," and three other teachers made similar remarks. A closer examination of ease of use in this study found that teachers' effort in using digital games in the classroom was moderated with adaptive learning games and exacerbated by issues that

occurred during implementation. Therefore, Research Question 1 will be answered in two parts: (a) adaptability and (b) issues.

Adaptability. The term adaptive refers to the capability of the DGBM to use data and analytics to evaluate students' skills and create "appropriate pathways and priorities for each student" (New Media Consortium, 2014). Adaptive learning games can create innovative opportunities for learning by utilizing built in analytics to support customized learning over time (Benton et al., 2021). Researchers have found an existing relationship between ease of use and adaptive content, indicating easy access is essential when using relevant and adaptive learning resources (Lai, Hwang, Liang, & Tsai, 2016). Data in the current study aligns with this research. HSES teachers like Heather preferred to use an adaptive game because it was easier to use and they "really like the time that it also saves." Survey participants agreed that learning to use DGBM was easy (M = 4.06, SD = 0.94), and that it was easy to use digital game-based materials in their classroom (M = 4.06, SD = 1.14), which extends statements expressed by the interview participants.

Not all participants found adaptive learning games easy to use, thereby adding connections between ease of use and adaptive technology. Because of adaptive assignments generated for the user, DGBM that create adaptive learning experiences improve teacher-participants' perceived ease of use. However, doubt about the game's ability to accurately place students on an independent level can decrease ease of use. Teacher-participants said they wanted students to be independently working on DGBM but were cautious about believing that students will be successful with all adaptive learning games. As Pattie stated, "You as a teacher do not have the time to go around and

individually teach every child…what a program may be presenting them." Adaptive learning perceptions such as these align with cautions presented in the literature. Researchers have speculated that students can experience issues while using DGBM because the adaptive condition could make it too difficult for them to move to the next level in the game and "after playing the same level several times, frustrations popped up and their motivation to continue the game might have decreased" (Vanbecelaere et al., 2020, p. 509).

Issues. Issues such as training, previous experience, and personal issues such as openness and innovativeness have been found to be barriers that influence teachers' acceptance of digital games (Sánchez-Mena & Martí-Parreño, 2017). Teacher intervention can resolve student issues, such as difficulties with the game they are playing (Vasalou et al., 2017). However, teachers have felt that their lack of knowledge and skills in teaching strategies is a challenge to the implementation of digital games in the classroom (Wu, H., 2015). Teachers like Pattie experienced issues with DGBM, thereby extending Wu's (2015) findings. The use of DGBM may decrease if teachers are spending time and effort resolving problems. Participants also expressed issues related to increased time and effort trying to troubleshoot problems and losing control of the classroom. Student technology proficiency, especially regarding younger students' ability to log into the game, also made DGBM harder to use. Teacher-participants expressed that these issues were often experienced at the beginning of the year when they were setting up routines and teaching procedures for logging in to the game-based material. For instance, "the hurdles with getting signed on" was an ease-of-use issue Pattie and five other teachers mentioned. In alignment with the findings of Sánchez-Mena and Martí-

Parreño (2017), teacher technology proficiency and training with DGBM was a cause of issues related to acceptance of DGBM by teachers at HSES.

Past research has suggested that ease of use could be negatively influenced by issues and barriers (Sánchez-Mena & Martí-Parreño, 2017; Wu, H., 2015). The teacher-participants elaborated on these findings by expressing neutrality, although tending towards agreement, that overall they find digital game-based materials easy to use (M = 3.94, SD = 1.06). Teachers in the study also expressed that ease of use influenced acceptance of DGBM when adaptive learning capabilities existed within the game, thereby corroborating the suggestion that ease of use and adaptive learning maintain a relationship (Lai et al., 2016) and confirming adaptive learning cautions presented by (Vanbecelaere et al., 2020).

Research Question 2: How, and to what extent, does self-efficacy influence teacher acceptance of digital game-based educational materials?

Venkatesh and Bala defined self-efficacy as an "individual's control beliefs regarding his or her personal ability to use a system" (p. 278). Individuals have typically anchored their self-efficacy to general beliefs about a technology and later adjusted their view of ease of use based on hands-on experience (Venkatesh & Bala, 2008). Confirming these findings, other teachers agreed that self-efficacy influenced acceptance of DGBM (M = 4.04, SD = 0.98). In the current setting, how and to what extent self-efficacy influences teacher acceptance of DGBM was complementary of how and to what extent teachers are (a) learning how to implement DGBM and (b) teaching their students how to use them.

Learning how. Confidence in HSES teachers' personal ability to use DGBM was expressed by their willingness to explore the game independent of any professional development or training. Teachers expressed they were more comfortable after exploring the game on her own and learning the procedures. Many other participants also have taught themselves how to use DGBM. It has been shown that professional development improves self-efficacy (An, 2018; Wu, H., 2015). Findings in the current study convey different results. Survey respondents were neutral, but favored towards agreement, that they could teach using DGBM if they had just the material's built-in help features for assistance (M = 3.94, SD = 0.87) and if there was no one around to tell them what to do as they go (M = 3.88, SD = 0.93). Learning how to use DGBM on their own could affect participants' self-efficacy beliefs and use of DGBM. Some HSES teachers said that not knowing how to use a digital game would make them nervous, while others expressed that they are more comfortable using other resources instead of DGBM. Because several teachers feel comfortable being able to use (DGBM) but prefer to teach themselves how to use them, the findings of the current study cannot corroborate findings that a lack of professional preparation could impede teachers' use of DGBM (Wu, H., 2015).

Teaching how. HSES teachers are not only exploring the games on their own to learn how to use them, but they also believe that letting the students explore on their own is the best way for them to learn how to use it. Even though teachers expressed confidence about teaching their students how to use DGBM, their self-efficacy could be improved with the assistance of a paraprofessional. When teachers tried to teach students how to play a game, issues led to frustrations. Some teachers preferred to use the assistance of another professional to teach their students how to use DGBM. These

findings agreed with other studies that have shown professional development improved teachers' perceptions, attitudes, and self-efficacy after completing training in the use of digital game-based learning (An, 2018; Huang & Oh, 2018). Additionally, Sanchez, Kim, and Weisburgh (2016) found that teachers "value what games can offer for students' learning and assessment" and are "eager to explore different pedagogical approaches and tap different skills but may require more technological support and relevant professional development" (p. 14). Teacher-participants substantiate relevant research with their agreement that they could teach using digital game-based materials if someone showed them how to do it first (M = 4.22, SD = 1.06).

Results of the current study show self-efficacy influenced teacher acceptance of DGBM but was mediated by teacher beliefs regarding learning how to implement DGBM and teaching students how to play the game. By exploring the game first, HSES teachers become more comfortable with the game mechanics and procedures, and more confident in their ability to teach their students the steps involved with using it, thus corroborating evidence that suggests self-efficacy is a mediator of use intent (Venkatesh, 2000; Venkatesh & Bala, 2008). However, the findings of the current study cannot corroborate research that suggests professional preparation increases acceptance and use of DGBM (An, 2018; Huang & Oh, 2018; Wu, H., 2015).

Research Question 3: How, and to what extent, does usefulness influence teacher acceptance of digital game-based educational materials?

Perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989, p. 320). If people do not believe a system to be useful, then they are unlikely to use it

(Davis, 1989). Evidence from teacher-participants confirmed findings from Ucus (2015) that elementary school teachers have developed different understandings for the usefulness of games. HSES teachers found DGBM useful because they were convenient resources that didn't take any time to prepare. Teachers perceived DGBM as useful if (students) can use them independently. Neutral agreement on the survey (M = 3.79, SD = 0.98) speaks to the extent participants were indifferent in their perceptions of usefulness for learning and productivity. Many HSES teachers were unsure if digital game-based materials allow students to learn more than would otherwise be possible (M = 3.67, SD = 1.24). Participant interviews revealed that their perceived usefulness corresponded to the extent to which DGBM can motivate and engage their students. Consequently, Research Question 3 will be answered in two parts: (a) motivation and (b) engagement.

Motivation. Research has shown that teachers believed digital games can improve student engagement, motivation, and the teaching or reinforcing of concepts (Sanchez et al., 2016; Takeuchi & Vaala, 2014). Interest and engagement in games have had positive effects on learning outcomes when students possess the motivation to learn new knowledge in the game (Domingo & Gargante, 2016; Hamari et al., 2016; Tsai, Yu, & Hsiao, 2012). Results of the current research survey revealed dissimilar results. When motivation was associated with increasing learning and productivity, teachers held more neutral beliefs that DGBM could improve learning performance (M = 3.83, SD = 0.99), student productivity (M = 3.78, SD = 0.88), and learning effectiveness (M = 3.78, SD = 0.88). Also, the efficiency of DGBM to improve learning speed (M = 3.83, SD = 0.86) was found to be a neutral factor in teachers' perceptions of usefulness.

Several HSES teachers found that DGBM are mainly useful for engagement and motivation but not necessarily useful for learning. Other data revealed that teachers' perceptions of usefulness stemmed more from a productivity and efficiency aspect. The motivating aspect of digital games permitted some teachers to perceive DGBM useful for motivating students through routines and activities. Use of technologies has been found to be strongly influenced by perceived usefulness (McFarland & Hamilton, 2006; Venkatesh & Davis, 2000; Yusoff, Crowder, & Gilbert, 2010). Teacher acceptance of DGBM in the current setting extends this research. Acceptance of DGBM by teachers at HSES was influenced by perceived usefulness when mediated by motivation.

Engagement. Teachers' perceived usefulness also corresponded to the extent to which DGBM could keep their students engaged in a learning task. In 2014, Takeuchi and Vaala found that 60% of teachers reported seeing an increase in attention to tasks and improved collaboration with their classmates after integrating digital games into their instruction. It was also found that educational digital games can present learning challenges that are enjoyable and interesting, bringing about measurable engagement and immersion in the learning (Hamari et al., 2016). Results from the current research study revealed results that are divergent from the literature. Survey respondents took a mostly neutral stance, although tending towards agreement, in their opinions that digital game-based materials are useful for learning (M = 3.93, SD = 0.96), make it easier for students to learn (M = 3.89, SD = 1.08), and improve students' learning quality (M = 3.89, SD = 0.83). Survey respondents were also unconvinced that DGBM gave students greater control over their learning process (M = 3.67, SD = 1.03). The power of engagement is more useful to some teachers for maintaining student effort than increasing cognitive

gains. DGBM are useful because students will engage in game-based learning longer than other tasks, but only if they can use it independently. In 2016, Domingo and Gargante surveyed teachers and revealed that increasing student engagement is a strong factor that determines the use of gaming apps in the classroom. Data from the current study corroborated this evidence and indicated perceived usefulness influenced teachers' acceptance of DGBM when the digital game can motivate and engage students to persevere in an independent learning task.

Research Question 4: How, and to what extent, does relevance influence teacher acceptance of digital game-based educational materials?

Relevance was defined as "an individual's perception regarding the degree to which the target system is applicable to his or her job" (Venkatesh & Davis, 2000, p. 191). If teachers perceive DGBM are not relevant, then they should not be considered valuable educational resources (Venkatesh & Davis, 2000). Researchers have established that perceived usefulness was significantly linked to behavioral intention to use certain technologies (Davis, 1989; Yusoff, Crowder, & Gilbert, 2010). Venkatesh and Davis (2000) also claimed that output quality and job relevance affect perceived usefulness. Researchers postulate that output quality can be defined as "how well a system performs tasks" (Venkatesh & Davis, 2000, p. 192). When individuals were given a choice of multiple relevant systems, they have been inclined to choose the system that gives them the highest output quality (Venkatesh & Davis, 2000). In line with this research, HSES teachers were neutral, but tended towards disagreement, that use of digital game-based materials will have no effect on the performance of their job (M = 3.33, SD = 1.03). Extending the literature, participants in the current study revealed the extent to which

relevance influences acceptance of DGBM corresponded to the extent to which the game can connect to the curriculum and provide learning opportunities for their students. Therefore, Research Question 4 will be answered by a discussion of the (a) curriculum connections and (b) learning opportunities teacher-participants perceived existing in the DGBM they use.

Curriculum connections. In the past, teachers have reported that the curriculum-relatedness of the game plays an important role in their attitude towards using digital game-based learning (De Grove et al., 2012; Sanchez et al., 2016). The findings of one study suggested that the adoption of educational video games was influenced by how well the game connected to the curriculum (Rocha, Tangney, & Dondio, 2018). In the current setting, the findings on the effects of curriculum connections on relevance are extended. Participants expressed a concern for the alignment of DGBM and state standers, saying that DGBM can become distracting for students if they are not aligned. Other teachers expressed concerns about the relevance of the game. Perceived relevance was evident when teachers said they could create standards-based assignments using digital game-based materials. HSES teachers also revealed perceptions about the extent to which relevance influenced acceptance of DGBM when considering teaching and learning. Survey participants were neutral about the effectiveness of DGBM increasing their job performance ($M = 3.50$, $SD = 1.10$) but were in higher agreement about the general extent to which use of digital game-based materials could assist them in their job ($M = 3.94$, $SD = 1.00$). Qualitative and quantitative findings in the current research setting have confirmed the literature speculating that limitations of curricular connections

in existing games could have a negative impact on teachers' attitudes and perceptions (An, 2018).

Learning opportunities. Studies showing positive correlations associated with learning outcomes have led researchers to suggest that educational digital games can improve cognitive gains and attitudes toward learning in students (Alzubi et al., 2018; Galindo, 2018; Hwa, 2018; Vogel et al., 2006). However, teacher-participants in the current study could not confirm this research. HSES teachers neither agreed nor disagreed that the use of DGBM can significantly increase the quality of teaching and learning (M = 3.65, SD = 1.00). They also took a neutral stance that usage of digital game-based materials is important, (M = 3.78, SD =1.17). Interview participants extended the current study's quantitative findings on the effects of relevance on DGBM acceptance. In a meta-analysis of game effectiveness, Ke (2009) determined that 52% of studies reported significant positive effects of computer-based games. This holds true in another meta-analysis where researchers found that digital games were on average more effective than nongame instructional conditions (Clark et al., 2016). The relevance of DGBM for teacher-participants was revealed in statements about reteaching the curriculum, which corroborated the positive effects of digital games found in literature. HSES teachers also expressed that the relevance of the digital game was improved when it could vary the teacher's instructional strategies and created deeper conceptual understanding, while others remarked about the effectiveness of DGBM for helping students master concepts.

Contrary to the findings of Venkaesh and Davis (2000), teacher-participants in the current setting neutrally agreed that relevance influenced their acceptance of DGBM

(M = 3.70, SD = 1.04). A closer look at relevance revealed that if digital games were perceived as connecting to the curriculum, they would also be seen as useful tools that could extend learning opportunities in the classroom, which in turn could positively influence teachers' use of the technology (De Grove et al., 2012). This evidence is corroborated in the current setting. Survey participants agreed that in their job, usage of digital game-based materials is relevant (M = 4.17, SD = 0.99) and one-on-one interviews showed relevance is mediated by the curriculum connections and learning opportunities the technology can create.

Research Question 5: How, and to what extent, does experience influence teacher acceptance of digital game-based educational materials?

Research has shown that experience acts as a modifier of behavioral intention to use certain technologies (Venkatesh & Bala, 2008) and that previous gaming experience was a significant influence on teachers' acceptance of educational video games (Sanchez-Mena & Parreno, 2017). Other researchers have suggested teachers face problems using digital games in their classrooms because of lack of experience (Ucus, 2015; Van Rosmalen & Westera, 2014). The literature is contradicted by the findings of the current study. Survey participants disagreed that experience affects acceptance of DGBM (M = 2.10, SD = 1.06). These participants also disagreed that they like playing digital games (M = 2.89, SD = 1.18) and almost half of the teachers interviewed concurred. Personal use of digital games by participants was reportedly low. Since digital games are being used in classrooms at HSES, findings suggested that the types of digital game-based learning experiences teachers allowed for their students influenced acceptance of DGBM more than teachers' personal gaming experience. Subsequently, Research

Question 5 will be answered with a discussion of HSES teachers' (a) authentic use and (b) the classroom experiences they create for their students.

Authentic use. Researchers have claimed that the authentic use of digital games was improved when teachers understood their role aimed to act as a facilitator, designing engaging tasks that allowed students to actively participate in the learning process (Altuna & Lareki, 2015). However, lack of certain pedagogical competencies can cause barriers that decrease the use of digital games in the classroom. Teacher competencies related to making pedagogical choices in lesson planning, interventions, and assessment can affect their decisions to use digital games as a learning resource (Nousiainen, Kangas, Rikala, & Vesisenaho, 2018). Contrasting experiences and preferences of HSES teachers revealed opposing competencies related to use. Several HSES teachers stated they liked video games and have played them in the past, while others stated they did not like video games. They also reported a low level of personal gaming experience. It has been shown that experience can change teachers' initial beliefs regarding curriculum-relatedness and ease of use in a positive way, but negative opinions based on experience can decrease perceived learning opportunities (De Grove et al., 2012). The purpose of the current study was not to try to find correlation amongst teachers' personal experiences with digital games, therefore the findings cannot confirm or disconfirm research that analyzed how teachers' experiences with video games influenced their perceptions of acceptance and use (De Grove et al., 2012).

Classroom experiences. Researchers have said that classroom teachers have not yet internalized the effective use of digital games and to better understand the potential of this technology they needed to associate DGBM with more familiar traditional activities

(Loperfido, Dipace, & Scarinci, 2019). These researchers claimed that "long-established practices act as a benchmark to give meaning to the new digital experiences" (Feldia Loperfido et al., 2019, p. 136). Many interview participants corroborated this research with statements regarding the digital game-based experiences they create for their students. It has been a long-established practice in the classroom to create learning stations or centers, thus allowing the classroom teacher to work with small groups of learners while the rest of the class is working independently or collaboratively on enriching and engaging activities. This practice has continued at HSES with the use of DGBM in independent small group activities, as evidenced in teacher-participant comments. Teachers at HSES also reported they enjoyed using DGBM for test review.

It has been suggested that experience could change teachers' initial beliefs regarding curriculum-relatedness, ease of use, and perceived learning opportunities (De Grove et al., 2012). It has also been suggested that the experience of playing an educational digital game was found to assist learners with conceptual understanding and positive learning (Sung, Hwang, Lin, & Hong, 2017), but many teachers expressed that their lack of experience was a challenge when trying to use educational digital games (Wu, H., 2015). The current mixed methods study was informed by examining teachers' experiences with using digital games in the classroom and teachers' perceptions of the influence of factors on their use of DGBM. The results of survey data and teacher statements corroborated the literature regarding experience-related behavioral intention to use technologies (Venkatesh & Bala, 2008).

Implications

This research study has important implications for me, leaders in education, as well as for the field of educational technology. Three types of implications are considered: (a) personal implications, (b) implications for professional development, (c) implications for future research.

Personal Implications

As a result of everything I experienced during this research study, I have learned several things that have reshaped my educational practices. Two of these lessons include (a) the knowledge I have gained about conducting research and (b) the strengthening of my epistemological beliefs.

Competence as research practitioner. The learning I experienced throughout this research study taught me many things about mixed-methods action research. Action research is called such because it is actionable. It is research that is conducted to test a new intervention/innovation or evaluate an existing intervention/innovation. Action research is also conducted to describe what is occurring in the context of the participants' experiences. In either case, the intent is for education professionals to work together to identify and correct local problems that exist within the researchers' sphere of influence (Creswell & Creswell, 2018).

The research method employed in this study was mixed methods. This type of research combines effective aspects of qualitative and quantitative methods. Qualitative methods use emerging questions, collect data within the participants' setting, use an inductive approach to analysis, have a narrative design, and often are used when the subject of inquiry has not been addressed with a certain sample (Creswell & Creswell,

2018). Quantitative methods examine relationships among measurable variables, use a deductive approach to analyze statistical data, have an experimental design, and are often used to evaluate the effectiveness of an intervention or innovation (Creswell & Creswell, 2018). While conducting mixed-methods action research, I learned about the importance of positioning myself within the context of the study, collaborating with the participants, collecting and reporting the participants' experiences in their own words, ensuring the validity and reliability of the data, and remaining ethical and unbiased when collecting and analyzing the data (Creswell & Creswell, 2018).

As a result of the research study, my aptitude for conducting literature reviews increased. Reviewing the relevant literature occurred many times throughout the research study. The time spent researching and the lessons learned along the way solidified understandings I had gained about the purposes of conducting literature reviews. Aligned with recommendations from other researchers, my purposes of conducting literature reviews were to provide a comprehensive and up-to-date review of digital games in the classroom, to learn about the state of knowledge about digital game acceptance and use in the classroom, to provide a justification for the research problem, to acknowledge the literature (or lack thereof) which conveyed the need for the study, to describe the conceptual framework behind the study, to provide justification for the methods and procedures used in the study, and rationalize the choice of research design and decisions about the selection of participants (Buss & Zambo, 2014; Galvan & Galvan, 2017; Plano Clark & Creswell, 2015).

Epistemology. As a teacher, I have seen ways in which technology has enhanced education, but I have also seen ways in which it is misused. Students are allowed to use

tablets, Chromebooks, laptops, and PCs. Teachers have a bountiful supply of apps and websites to choose from. Students are eager to be engaged and involved with almost anything technological. Teachers understand that this desire is already there, so they try to infuse technology into any and every lesson. I want to be able to help others use technological resources better. But not just by presenting the next best app, the newest website, what's hot, or what's trending. I want teachers to be able to find the next best thing on their own because they understand how technology needs to be used for authentic learning, not just as a motivator. I want them to have the level of educational technological pedagogical knowledge they need to be self-reliant in their search for resources.

My epistemological beliefs prior to this research study were based on my experiences as an educator. Experience is best described as "the collection of events that make up one's conscious life" (Buoncristiani & Buoncristiani, 2012, p. 22). At the beginning of the research study, pragmatism aligned well with my research interests. Pragmatists, like mixed-methods researchers, look at both quantitative and qualitative data when conducting research and do not commit to any specific philosophical system to provide the best understanding of the current problem (Creswell & Creswell, 2018). Epistemology in pragmatism guides the researcher through problem solving methods because, according to Morgan (2014), "the origins of our beliefs arise from our prior actions and the outcomes of our actions are found in our beliefs" (p. 1046). My low level of research experience prior to this study was a large influence on my pragmatic beliefs. Many aspects of pragmaticism continue to influence my aptitude as an action researcher. However, while concluding this research study I am now understanding that many of my

epistemological beliefs parallel the constructivist/interpretivist paradigm. Obvious aspects of the constructivist/interpretivist paradigm highlight the research methods that were employed. The constructivist/interpretivist paradigm finds value in understanding of the world, generates varied and complex views constructed through the lens of participants' experiences, and relies on the participants' answers to broad questions about the situation being studied (Creswell & Creswell, 2018).

Recommendations for Professional Development

As this study has shown, many researchers have justified the significance of digital game-based materials (DGBM) and presented what they think about challenges and issues about using digital games for educational purposes (see Chapter 2). However, there are other factors that influence a teacher's decision to accept DGBM. For teachers to authentically integrate DGBL, effective teacher training and professional development are crucial (Ketelhut & Schifter, 2011; McManis & Gunnewig, 2012; Ucus, 2015). Researchers recommended professional development that includes focused attention to multiple factors, including providing time to develop self-efficacy with and ownership over the digital game, providing teachers with models of successful implementation, and providing teachers with just-in-time support (Ketelhut & Schifter, 2011). Huang and Oh (2018) extended the work of Ketelhut and Schifter and recommended providing teachers a variety of well-designed digital games and giving them an opportunity to design their own learning environments to help them fully understand the possibilities of using DGBM. HSES teachers expressed a desire to have time to talk about DGBM and to get ideas from other coworkers. In a national survey of 513 K-8 teachers, Takeuchi & Vaala (2014) found that only 8% of K-8 teachers report receiving preservice training on digital

game integration, 33% first learned about using games from another teacher, coach, or supervisor, and 68% stated they would prefer to go to other teachers within their school or district for ongoing professional development about using digital games in the classroom. In line with this research, I suggest that HSES teachers' acceptance of DGBM could be improved through professional development that comes from a trusted coworker who is knowledgeable about the specific DGBM available at the school, can relate the real-world problems that they experience and overcome, how the DGBM improves teaching and learning in their classroom, and has the data and information to support the use of DGBM. This professional development opportunity could focus on strategies such as (a) scaffolding techniques and (b) the design of digital game-based learning opportunities.

Scaffolding. Many teachers at HSES expressed concerns and frustrations with their students' lack of proficiency with technological devices and logging in to the available DGBM. Scaffolding techniques related to improving student proficiency with the game, proficiency with the technological devices, and proficiency with logging in to the available DGBM will improve teachers' perceived ease of use. The decision of when to provide scaffolding and what type of scaffolding to use is something teachers should consider. Providing a scaffold before game play has led to significantly better learning achievements and problem-solving than using DGBL without a scaffold or presenting a scaffold after the game (Barzilai & Blau, 2014; Sung & Hwang, 2018). Brush and Saye (2002) separate scaffolds into two types, (a) soft scaffolds and (b) hard scaffolds.

Soft scaffolds. Soft scaffolds, such as timely feedback, are "dynamic, situation-specific aid provided by a teacher or peer to help with the learning process" (Brush &

Saye, 2002, p. 2). In the beginning of the year when students are learning procedures and expectations, teachers should intervene often during game play to demonstrate and model how to use the game. Teacher intervention can be a form of scaffolding that resolves issues students often experience, such as difficulties with the game they are playing (Vasalou et al., 2017). Through proper modeling and demonstration, teachers can improve students' proficiency, thus improving perceived ease of use of DGBM.

Hard scaffolds. Hard scaffolds, such as pre-planned instructions, are "static supports that can be anticipated and planned in advance based upon typical student difficulties with a task" (Brush & Saye, 2002, p. 2). Whenever possible, teachers should instruct students in the ways in which the game connects to the content being learned in the classroom. A common finding in research studies was that students who play digital games without instructional scaffolds learn to play the game rather than learning the educational content of the game (Ke, 2009). Combining instructions with feedback on the correctness of student responses yielded better understanding and improved engagement (Erhel & Jamet, 2013). In addition to specific preplanned instructions, HSES teachers should provide hard scaffolds in the form of audio enhanced slideshows the students can access at any time. The slideshow should include screenshots of what students will experience, combined with audio narration of the steps and procedures for logging in and accessing the content, in order to improve student understanding and proper use of DGBM.

Learning opportunities. HSES teachers revealed the extent to which relevance influenced acceptance of DGBM corresponded to the extent to which the game can connect to the curriculum. Teachers need to know how to analyze a game's curricular

connections so they can use the game for specific learning tasks (Foster & Shah, 2020). Therefore, I suggest that teacher training and collaboration on how to provide effective digital game-based learning opportunities could influence teachers' perceived relevance of DGBM. This can be accomplished by providing time and opportunity for HSES teachers to collaboratively explore the game-based material, go through the procedures necessary for creating adaptive activities/assignments, learning how to access and use the game analytics and reports, and planning effective and efficient digital game-based learning opportunities for students. Ideally, this opportunity should take place immediately following training of a DGBM. HSES teachers expressed that their perceived usefulness corresponded to the extent to which DGBM can motivate and engage their students. Engagement can be increased through game elements that foster social interaction (Vasalou et al., 2017). Researchers advise caution when using games as extrinsic motivation, such as rewards and incentives, because they can decrease a player's engagement and intrinsic motivation (Faiella & Ricciardi, 2015; Huang, 2011). Using digital games has been found to be more effective when they were combined with other instructional methods, such as cooperative learning (Wouters, Nimwegen, & Spek, 2013). Teachers should allow students to work together as partners or in small collaborative groups even when engaged in individual game-based activities. Students can motivate each other and help each other when issues occur. Working with peers during game-based activities can be a form of scaffolding that helps with the learning process (Brush & Saye, 2002). Learning how to create effective digital game-based learning opportunities could improve HSES teachers' perceived usefulness and perceived relevance of DGBM.

Implications for Future Research

The current study has implications for educational leaders in the Kaia County School District. The Director of Technology Integration as well as technology integration specialists employed in the district who facilitate professional development for elementary classroom teachers may be interested in future research related to improving teachers' perceptions of DGBM, thus improving their acceptance and use of DGBM. Because self-efficacy, relevance, usefulness, and ease of use were influences on digital game acceptance at HSES, future research should focus on examining teachers' perceptions on a larger scale. The survey instrument used in this study could be further validated by a larger sample of participants from elementary schools in KCSD. A larger sample size could also create an opportunity to conduct regression analysis and possibly identify causal relationships between the constructs.

The current study also has implications for future survey research on KCSD teachers' current technological pedagogical content knowledge of digital games using the TPACK-G survey. The TPACK-G survey was developed by Hsu et al. (2013), is based on the previous works of Mishra and Koehler (2006), Lee and Tsai (2010), and Chai, Koh, and Tsai (2013), and had reported high reliability. The TPACK-G measures participants' confidence on three scales: (1) Game Knowledge (GK) – the teacher knows how to use digital games, (2) Game Pedagogical Knowledge (GPK) – the teacher knows how to use digital games to enhance students' learning, and (3) Game Pedagogical Content Knowledge (GPCK) – the teacher knows how to use appropriate pedagogy and digital games to support students' learning of specific content (Hsu, Liang, & Su, 2015). The TPACK-G has been used in several research studies related to exploring teacher's

technological pedagogical content knowledge of educational games, game-based teaching, and game-based learning (Hsu et al., 2013; Hsu et al., 2015; Hsu, Tsai, Chang, & Liang, 2017).

The current study also has implications for increasing teachers' perceptions of DGBM through professional development opportunities. Extending the results of the current study on a larger scale using an experimental design may allow researchers to examine the effects of professional development on improving elementary teachers' perceptions of and experiences with DGBM. There is an established need for teacher education that improves competence areas in game-based learning (Nousiainen et al., 2018). Proper training in game-based pedagogical knowledge could lead to improved use of digital games in the classroom and advance the quality of a teacher's professional expertise. The next steps in improving the research field related to game-based pedagogy will be to examine the effects of a professional development course designed using the TPACK-G framework. Past research has used the TPACK-G framework to examine the effects of a technology- and pedagogy-oriented course design on improving in-service preschool teachers' TPACK-G as well as their acceptance of digital game-based learning (Hsu et al., 2015). That study found that teachers who were taught with game knowledge first tended to have higher competencies in game knowledge and game pedagogical content knowledge than those who were first instructed with game pedagogical knowledge (Hsu et al., 2015). After preliminary data are collected using the TPACK-G survey, future research should replicate the Hsu et al. study in the context of the Kaia County School District. Professional development that focuses on increasing teachers' technological and pedagogical content knowledge with digital games could examine the

effects of professional development on improving KCSD elementary teachers' perceptions of and experiences with DGBM.

Limitations

As with all research studies, this action research study has limitations. Findings of the current study have broadened prior technology acceptance research but should not be generalized beyond the local context. In action research, the purpose is to identify and correct problems, and the participants are often purposeful samples of local teachers or local education professionals. This is contrary to traditional research where the researchers may not be directly involved in the local situation and the goal is to produce knowledge that is generalizable (Mertler, 2017; Reeves & Oh, 2017). Coghlan and Brannick (2005) also explain that action research is a sequence of iterative cycles that involve gathering, analyzing, and reporting data, then taking action that leads to further data gathering.

Another limitation of the study was related to the survey instrument. The survey used a five-point Likert scale. There were many items that had means close to neutral. Research on using Likert scales without neutral scores has suggested that the removal of a neutral mid-point forces respondents to make a choice and results in more negative ratings than when a mid-point was available (Garland, 1991). However, Worcester and Burns (1975) found that respondents selected more positive ratings when neutral mid-points were omitted. Using a Likert scale with a neutral midpoint is appropriate for educational research, but limitations can be reduced through careful consideration of midpoint labels, clear definitions of midpoint labels, the inclusion of the N/A option, and the increase in scale range (Tsang, 2012). Several research studies on educational digital

games effectively used survey instruments that contained a 7-point Likert scale (Hamari & Koivisto, 2014; Kuo & Chuang, 2016; Mekler, Brühlmann, Tuch, & Opwis, 2017). A 7-point Likert scale could have revealed more accurate perceptions of HSES teachers' acceptance of DGBM.

The small sample size of participants in this study is another limitation worth mentioning. The adverse rate of participation in the survey (i.e., lower than 50% return) could have led to misrepresentation of the teacher population at HSES. Also, nine participants were close to the anticipated sample size for one-on-one interviews (i.e., 12), but there was no representation from 5th grade. However, a small sample size in qualitative research is not always a limitation. Qualitative research often focuses on relatively small samples that are selected purposefully (Patton, 2002). As stated earlier, the purpose of action research is not to generalize the results. A purposeful random sample can add credibility to a study, even though it does not allow for generalizations (Patton, 2002).

Conclusion

The purpose of this research study was to explore ease of use, usefulness, relevance, self-efficacy, and past experiences to describe influences on elementary teachers' acceptance of digital game-based materials. The questions this study intended to answer were (1) How, and to what extent, does ease of use influence teacher acceptance of digital game-based educational materials; (2) How, and to what extent, does self-efficacy influence teacher acceptance of digital game-based educational materials; (3) How, and to what extent, does usefulness influence teacher acceptance of digital game-based educational materials; (4) How, and to what extent, does relevance influence

teacher acceptance of digital game-based educational materials; (5) How, and to what extent, does experience influence teacher acceptance of digital game-based educational materials? The answers to these questions are presented in this chapter through an integration of relevant research, qualitative data from teacher interviews, and quantitative data from the survey to present the (a) discussion, (b) implications, and (c) limitations of the research study.

Teachers' perceived ease of use was moderated with adaptive learning games and exacerbated by issues that occurred during implementation. Data in the current study suggests an existing relationship between ease of use and adaptive content. HSES teachers' agreement with statements of perceived ease of use were shown to be highly influential on DGBM acceptance (M = 4.01, SD = 0.99). HSES teachers preferred to use an adaptive game because it was easier to use, but doubts regarding the game's ability to accurately place students on an independent level can decrease ease of use. The use of DGBM may decrease if teachers are spending time and effort resolving problems. Student technology proficiency, especially regarding younger students' ability to log into the game, increased perceived ease of use.

HSES teachers' agreement with statements of perceived self-efficacy were also shown to be highly influential on DGBM acceptance (M = 4.04, SD = 0.98). In the current setting, how and to what extent self-efficacy influenced teacher acceptance of DGBM was complementary of how and to what extent teachers were learning how to implement DGBM and teaching their students how to use them. Results showed self-efficacy influenced teacher acceptance of DGBM but was mediated by teacher beliefs regarding learning how to implement DGBM and teaching students how to play the

game. Self-efficacy was expressed by teachers' willingness to explore the game independent of any professional development or training. Findings indicated that learning how to use DGBM on their own could affect HSES teachers' self-efficacy beliefs and use of DGBM. Teachers also expressed confidence about teaching their students how to use DGBM, but their self-efficacy could be improved with the assistance of a paraprofessional.

HSES teachers' agreement with statements of perceived usefulness was shown to moderately influence acceptance (M = 3.71, SD = 0.85). Participants revealed that their perceived usefulness corresponded to the extent to which DGBM can motivate and engage their students. Acceptance of DGBM by teachers at HSES was influenced by perceived usefulness when mediated by motivation. Teachers found DGBM useful for motivating students through routines and activities. Data indicated perceived usefulness also influenced teachers' acceptance of DGBM when the digital game engaged students to persevere in an independent learning task. Teachers found the power of engagement more useful for maintaining student effort than increasing cognitive gains.

HSES teachers' agreement with statements of perceived relevance was shown to moderately influence acceptance (M = 3.56, SD = 0.98). Participants revealed the extent to which relevance influences acceptance of DGBM corresponded to the extent to which the game can connect to the curriculum and provide learning opportunities for their students. Teacher-participants in the current setting neutrally agree that relevance influenced their acceptance of DGBM. Data suggested perceived relevance was influenced by teachers' ability to create standards-based assignments using digital game-based materials. Limitations of curricular connections in DGBM could have a negative

impact on teachers' perceived relevance. Participants expressed that the relevance of the digital game was improved when it could vary the teacher's instructional strategies and created deeper conceptual understanding.

HSES teachers' agreement with statements of experience was the least influential construct tested in the study. Personal use of digital games by interview participants was also reportedly low and survey participants disagreed that experience affects acceptance of DGBM (M = 2.10, SD = 1.06). However, digital games are being used in classrooms at HSES. Therefore, findings suggested that the types of digital game-based learning experiences teachers allowed for their students influenced acceptance of DGBM more than teachers' personal gaming experience. Data revealed that participants create learning stations or centers using DGBM, thus allowing the classroom teacher to work with small groups of learners while the rest of the class is working independently or collaboratively on enriching and engaging activities.

The current study has implications for educational leaders in the Kaia County School District. Educational leaders in the district who facilitate professional development for elementary classroom teachers may be interested in future research related to improving acceptance and use of DGBM. Because self-efficacy, relevance, usefulness, and ease of use were influences on digital game acceptance, professional development should aim to increase these constructs by improving teachers' technological and pedagogical content knowledge of digital games. Professional development designed using the TPACK-G framework could accomplish this goal. Extending the results of the current study on a larger scale using an experimental design

may allow researchers to examine the effects of this professional development on improving KCSD elementary teachers' perceptions of and experiences with DGBM.

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APPENDIX A: EMAIL REQUEST FOR PARTICIPANTS

Dear colleague,

I am Andrew Simpson. I am conducting a research study for the Curriculum and Instruction, with emphasis in educational technology, educational doctorate program at the University of South Carolina. I would like to invite you to participate in this study to collect information that may be used to investigate the acceptance of digital game-based materials for instructional purposes.

Digital game-based materials are computer programs, tablet applications, and websites that use digital games and/or gamified elements. There are many acceptance factors that might influence teachers' intent to use digital game-based materials. Many of these factors are currently unknown. An in-depth study of this problem may allow me to describe how elementary teachers' perceptions inform their acceptance of digital game-based materials. This may allow elementary schools to revise their school improvement plan to better define educational technologies and professional learning opportunities.

Your participation will help me collect qualitative information to describe how perceptions, opinions, beliefs, and experiences may influence teachers' decisions to use (or not use) educational digital game-based materials in the classroom. You do not have to currently use digital game-based materials in your classroom to participate. I am looking for all levels of experience with digital game-based materials, so anyone with any experience is invited.

The study will use a survey and one-on-one interviews to collect information regarding teachers' perspectives and experiences using educational digital game-based materials. The interviews will be conducted virtually or face-to-face, whichever you are most comfortable with. If you or your students currently use educational digital game-based materials, we will schedule a 45-minute classroom observation based on your availability.

Your participation is valuable and appreciated. However, understand that your participation is strictly voluntary. If you consent, your identity will be confidential. To ensure anonymity, your name and other personally identifiable information will not be published. I will design specific procedures to protect the identity of the participants. These procedures may include removing personal information once the data has been

collected, creating keys that link participants' names to unique codes, and/or assigning pseudonyms.

I will be happy to answer any questions that you have about the study. You may contact me anytime via email at _____@fortmillschools.org. If you are willing to participate, please reply to this email.

Sincerely,

Andrew Simpson

APPENDIX B: SURVEY INSTRUMENT

Survey of Teachers' Perceptions About Digital Game-Based Materials

Thank you for participating in this study to collect information that may be used to investigate the acceptance of digital game-based materials for instructional purposes. Your participation will help collect qualitative information to describe how perceptions, opinions, beliefs, and experiences may influence teachers' decisions to use (or not use) educational digital game-based materials in the classroom. You do not have to currently use digital game-based materials in your classroom, but you do have to have knowledge of and experiences with using digital game-based materials. This survey will collect information regarding whether you agree or disagree with certain statements about digital game-based materials. The survey will also include a personal information section to ascertain the characteristics of the survey participants. Participation is anonymous. To ensure anonymity, your name and email address is not included in the personal information section of the survey. If you consent to participate, please proceed to the next section.

* Required

Personal Information

1. Gender Identification *

Mark only one oval.

- ◯ Female
- ◯ Male
- ◯ Prefer not to say
- ◯ Other: _____

2. Number of years teaching at the primary and/or elementary level (not including the current school year). If you are a first year teacher, please enter zero. *

_____

_____

_____

_____

_____

3. What grades have you taught? *

4. What grade level do you currently teach? *

Mark only one oval.

- ◯ Kindergarten
- ◯ First
- ◯ Second
- ◯ Third
- ◯ Fourth
- ◯ Fifth
- ◯ Other: _____

5. What subject area(s) do you currently teach?

6. What postgraduate degrees do you hold?

7. Do you currently teach virtually, face-to-face, or hybrid?

Mark only one oval.

- Yes
- No

Perceived Usefulness of Digital Game-Based Materials

Digital game-based materials are computer programs, tablet applications, and websites that use digital games and/or gamified elements. Please rate how strongly you agree or disagree with the following statements.

8. How strongly do you agree or disagree with the following statements? *

Check all that apply.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Digital game-based materials improve students' learning quality.	☐	☐	☐	☐	☐
Digital game-based materials give students a greater control over their learning process.	☐	☐	☐	☐	☐
Digital game-based materials enable students to learn more quickly.	☐	☐	☐	☐	☐
Digital game-based materials support critical aspects in the students' learning process.	☐	☐	☐	☐	☐
Digital game-based materials increase students' productivity.	☐	☐	☐	☐	☐
Digital game-based materials improve students' learning performance.	☐	☐	☐	☐	☐
Digital game-based materials allow students to learn more than would otherwise be possible.	☐	☐	☐	☐	☐
Digital game-based materials enhance students' learning effectiveness.	☐	☐	☐	☐	☐
Digital game-based materials make it easier for students to learn.	☐	☐	☐	☐	☐
Overall, I find digital game-based materials useful for learning.	☐	☐	☐	☐	☐

Perceived Ease of Use of Digital Game-Based Materials

Digital game-based materials are computer programs, tablet applications, and websites that use digital games and/or gamified elements. Please rate how strongly you agree or disagree with the following statements.

9. How strongly do you agree or disagree with the following statements? *

Check all that apply.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Learning to use digital game-based materials is easy for me.	☐	☐	☐	☐	☐
I find it easy to use digital game-based materials in my classroom.	☐	☐	☐	☐	☐
Digital game-based materials are clear and understandable for me.	☐	☐	☐	☐	☐
Overall, I would find digital game-based materials easy to use.	☐	☐	☐	☐	☐

Perceived Relevance of Digital Game-Based Materials

Digital game-based materials are computer programs, tablet applications, and websites that use digital games and/or gamified elements. Please rate how strongly you agree or disagree with the following statements.

10. How strongly do you agree or disagree with the following statements? *

Check all that apply.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
In my job, usage of digital game-based materials is important.	☐	☐	☐	☐	☐
In my job, usage of digital game-based materials is relevant.	☐	☐	☐	☐	☐

Self-Efficacy in Using Digital Game-Based Materials

Digital game-based materials are computer programs, tablet applications, and websites that use digital games and/or gamified elements. Please rate how strongly you agree or disagree with the following statements.

11. How strongly do you agree or disagree with the following statements? *

Check all that apply.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I could teach using digital game-based materials if there was no one around to tell me what to do as I go.	☐	☐	☐	☐	☐
I could teach using digital game-based materials if I had just the help features built-in the game for assistance.	☐	☐	☐	☐	☐
I could teach using digital game-based materials if someone showed me how to do it first.	☐	☐	☐	☐	☐
I could teach using digital game-based materials if I had used similar teaching methods before using educational digital games.	☐	☐	☐	☐	☐

Experience in Using Digital Game-Based Materials

Digital game-based materials are computer programs, tablet applications, and websites that use digital games and/or gamified elements. Please rate how strongly you agree or disagree with the following statements.

12. How strongly do you agree or disagree with the following statements? *

Check all that apply.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I would describe myself as a gamer.	☐	☐	☐	☐	☐
Compared to people of my age, I play a lot of digital games.	☐	☐	☐	☐	☐
I play different types of digital games.	☐	☐	☐	☐	☐
I often play digital games.	☐	☐	☐	☐	☐
I like playing digital games.	☐	☐	☐	☐	☐

APPENDIX C: COMPARISON OF SURVEY ITEMS

Table C.1 *Comparison of Survey Items*

Existing Items	**Source**	**New Item**
Educational video games improve students learning quality	(Sánchez-Mena et al., 2019)	Digital game-based materials improve students' learning quality.
Educational video games give students a greater control over their learning process	(Sánchez-Mena et al., 2019)	Digital game-based materials give students a greater control over their learning process.
Educational video games enable students to learn more quickly	(Sánchez-Mena et al., 2019)	Digital game-based materials enable students to learn more quickly.
Educational video games support critical aspects in the students´ learning process	(Sánchez-Mena et al., 2019)	Digital game-based materials support critical aspects in the students' learning process.
Educational video games increase students productivity	(Sánchez-Mena et al., 2019)	Digital game-based materials increase students' productivity.
Educational video games improve students learning performance	(Sánchez-Mena et al., 2019)	Digital game-based materials improve students' learning performance.
Educational video games allow students to learn more than would otherwise be possible	(Sánchez-Mena et al., 2019)	Digital game-based materials allow students to learn more than would otherwise be possible.
Educational video games enhance students learning effectiveness	(Sánchez-Mena et al., 2019)	Digital game-based materials enhance students' learning effectiveness.
Educational video games make it easier for students to learn	(Sánchez-Mena et al., 2019)	Digital game-based materials make it easier for students to learn.
Overall, I find educational video games useful for learning	(Sánchez-Mena et al., 2019)	Overall, I find digital game-based materials useful for learning.
Learning to use educational video games is easy for me	(Sánchez-Mena et al., 2019)	Learning to use digital game-based materials is easy for me.
I find it easy to use educational video games to teach my classes	(Sánchez-Mena et al., 2019)	I find it easy to use digital game-based materials in my classroom.
Educational video games are clear and understandable for me	(Sánchez-Mena et al., 2019)	Digital game-based materials are clear and understandable for me.

Existing Items	Source	New Item
In my job, usage of the system is important.	(Venkatesh & Davis, 2000)	In my job, usage of digital game-based materials is important.
In my job, usage of the system is relevant.	(Venkatesh & Davis, 2000)	In my job, usage of digital game-based materials is relevant.
Use of a PC will have no effect on the performance of my job.	(Thompson et al., 1991)	Use of digital game-based materials will have no effect on the performance of my job.
Use of a PC can significantly increase the quality of output of my job.	(Thompson et al., 1991)	Use of digital game-based materials can significantly increase the quality of teaching and learning.
Use of a PC can increase the effectiveness of performing job tasks.	(Thompson et al., 1991)	Use of digital game-based materials can increase the effectiveness of performing my job.
A PC can increase the quantity of output for the same amount of effort.	(Thompson et al., 1991)	Use of digital game-based materials can increase the quantity of teaching and learning for the same amount of effort.
Considering all tasks, the general extent to which use of PC could assist on job.	(Thompson et al., 1991)	Considering teaching and learning, the general extent to which use of digital game-based materials could assist me in my job.
I could complete the job using a software package if there was no one around to tell me what to do as I go.	(Venkatesh & Bala, 2008)	I could teach using digital game-based materials if there was no one around to tell me what to do as I go.
I could complete the job using a software package if I had just the built-in help facility for assistance.	(Venkatesh & Bala, 2008)	I could teach using digital game-based materials if I had just the material's built-in help features for assistance.
I could complete the job using a software package if someone showed me how to do it first.	(Venkatesh & Bala, 2008)	I could teach using digital game-based materials if someone showed me how to do it first.
I could complete the job using a software package if I had used similar packages before this one to do the same job.	(Venkatesh & Bala, 2008)	I could teach using digital game-based materials if I had previously used similar teaching methods.
I would describe myself as a gamer.	(Hsu et al., 2013)	I would describe myself as a gamer.
Compared to people of my age, I play a lot of digital games.	(Hsu et al., 2013)	Compared to people of my age, I play a lot of digital games.
I play different types of digital games.	(Hsu et al., 2013)	I play different types of digital games.

I often play digital games.	(Hsu et al., 2013)	I often play digital games.
I like playing digital games	(Hsu et al., 2013)	I like playing digital games.

APPENDIX D: INTERVIEW PROTOCOL AND SCRIPT

Good morning/afternoon Mr./Mrs. ____. Thank you for consenting to participate in this study. I will be recording our interview, as well as taking notes, to ensure the data is accurate. Only I will have access to this recording, and once I have transcribed it, it will be anonymized by creating pseudonyms for each participant. Identifiable information in the transcription will also be neutralized. A key matching each participant to his/her pseudonym and each neutralized term with its anonymous form will be created and kept confidential. In addition, your participation in this interview is voluntary, and you may choose not to answer any of the questions and/or stop participation at any point.

Please understand that my purpose in this interview is not to judge you or your answers as positive, negative, right, or wrong. I am simply trying to learn more about elementary teachers' acceptance of digital game-based educational materials to supplement or enhance instruction. The information you provide today could provide valuable information that will allow me to describe teachers' perceptions so that I can recommend the actions and next steps Kaia County School District needs to take in regard to using, promoting, purchasing, and/or training regarding digital game-based educational materials.

During this interview, you will hear me use terms such as digital game-based educational materials, educational purposes, instructional purposes, usefulness, ease of use, self-efficacy, relevance, and experiences. In a previous email I provided you definitions and explanations of these terms. I am also giving you a printed copy now to use during the interview. Do you have any questions for me now about these terms and definitions?

The entire interview should take about 30 minutes. Would you like any water or anything before we begin? Do you have any questions?

Ok. Let's get started. I would like to begin by gathering some personal information.

1. *How many years have you been teaching?*
2. *What grades have you taught?*
3. *What grade are you currently teaching?*
4. *What subject area do you currently teach?*
5. *Do you have any graduate degrees?*
6. *What teaching certifications do you have?*
7. *Do you have any additional certifications?*
8. *Do you teach virtually, face-to-face, or hybrid?*

Thank you. Is there any other personal information you feel would be related to this study?

Ok. Now we'll move on to discussing specific topics related to using digital games in your classroom. It is ok you don't have much, or any, experience with these topics. I'm trying to find out your views about certain aspects of using digital games as instructional materials. It is your perspective that matters most. Your opinions may be based on prior experiences and knowledge of digital games, but they can also be based on feelings, insights, and/or observations.

1. ***Can you describe for me the effort you feel it would take for you use a digital game-based material in a lesson or activity?***

   Probing questions if necessary:

   1) *Talk about the effort on your part.*
      a) *Can you describe for me the effort you feel it would take to plan, prepare, and implement an activity where students are using a digital game-based material?*
         i) *What would you need to do?*
         ii) *How would you prepare or get ready for that day?*
         iii) *What resources would you use?*
         iv) *Do you already have the resources in your classroom, or would you need to acquire them?*
         v) *Would you need anyone's help? Who? How would they help you?*
         vi) *In your opinion, what might be some issues you would experience trying to use digital game-based materials or trying to use them more often?*
         vii) *Can you give me an example of an activity that uses a digital game-based material?*
      b) *What are some digital game-based materials you've heard of before?*
         i) *How did you hear of those?*
         ii) *How would you go about learning what other digital game-based materials are available?*
         iii) *How would you learn how to use them?*
         iv) *How would you teach your students to use them?*
   2) *What issues may occur with your students using digital game-based materials or using them more often?*
      a) *What might cause those issues?*
      b) *What solutions might help?*
   3) *What is your opinion about the overall effort it would take to use digital game-based materials or use them more often in your classroom? Why do you say that?*
   4) *Tell me about what you believe might make planning, preparing, and implementing digital game-based activities easier.*
      i) *What would make planning the activity easier?*

ii) What would make preparing the activity easier?
iii) What would make implementing the activity easier?
iv) Would all of that effort be worth it? Why or why not?

2. Can you please describe your personal ability to use digital game-based materials in a lesson or activity?

Probing questions if necessary:

1) How comfortable are you with technology overall? Can you tell me more?
2) Please describe your opinion of your ability to use digital game-based materials with a lesson or as part of an activity?
   a) Finding new ones to use?
   b) Knowing how to use them?
   c) Knowing where and when to use them?
   d) Teaching your students to use them?
   e) Heling students if issues arise while they are using the materials?
3) What do you believe contributes to a feeling of self-confidence in using digital game-based materials?
4) What do you believe causes doubt in your ability to use digital game-based materials?
5) Can you describe your ability to help your students while they are playing digital games or participating in digital game-based activities?
6) What is your opinion about increasing your ability to use digital game-based materials?
   a) Would you want to improve your ability? Why or why not?
   b) What would you like to have happen that could increase your ability to use digital game-based materials or use them more often?
7) Do you play video games?
   a) Why do you play them?
   b) How often do you play them?
   c) Why don't you play them?
   d) Have you ever played them?
   e) Why not?
   f) What do you remember about that experience?
      i) Was the game hard or challenging?
      ii) Did you enjoy it?
      iii) Did you want to play it again afterwards?

3. What is your opinion about the usefulness of digital game-based materials?

Probing questions if necessary:

1) What is your opinion about the usefulness of digital game-based materials in your teaching?
   a) In what way are they useful?
   b) In what ways are they useless?

2) *What do you believe makes digital game-based materials useful?*
    a) *How do digital game-based materials enhance teaching?*
    b) *What do you believe are the benefits to using digital game-based materials?*
    c) *What changes in teaching and learning occur because of using digital game-based materials in your classroom?*
    d) *What improvements in your teaching are made because of using digital game-based materials?*
3) *What do you believe about using digital games to improve your performance?*
    a) *How do you see it improving your teaching?*
    b) *How do you see it decreasing your teaching?*
4) *What do you believe about using digital games to improve student performance?*
    a) *How do you see it improving student learning?*
    b) *How do you see it decreasing or diminishing student learning?*
    c) *How would you assess this?*
    d) *How do you see it improving student engagement?*
    e) *How do you see it decreasing or diminishing student engagement?*
    f) *How would you assess this?*
5) *What would you like to see happen that could increase the usefulness of digital game-based materials?*

4. How relevant do you find digital game-based materials to your teaching methods?

Probing questions if necessary:

1) *How relevant are digital game-based materials in your classroom?*
    i) *Why do you think that is?*
    ii) *Can you elaborate?*
2) *How significant are digital game-based materials to the success of your students' learning the curriculum? Can you explain that further?*
3) *Where would digital game-based materials fit in with your instructional planning?*
    a) *How would you use them?*
    b) *When or where would you use them?*
    c) *What subjects are most relevant to digital game-based materials?*
4) *What bearing do digital game-based materials have on your teaching?*
    a) *How could those materials impact or influence your planning and/or instruction?*
    b) *How could they impact or influence the activities you want your students completing?*
5) *Tell me about some digital games you feel are relevant to use in your classroom?*
    a) *What types of digital game-based materials are most relevant to your teaching?*
    b) *Can you name a few?*

c) *What makes them relevant?*
d) *What would make them more relevant?*

6) *In your opinion, do digital game-based materials improve your teaching?*
   a) *Why or why not?*
   b) *What are some examples of how it improves your teaching?*
   c) *What are some examples of how it decreases your teaching ability?*
7) *What would you like to see happen to improve the relevance of digital game-based materials?*
   a) *What would you like to see happen that will make them more applicable to your teaching?*
   b) *What would you like to see happen that will make them more applicable to your curriculum?*

5. Can you tell me about your experiences using digital game-based materials?

a. *Would you describe yourself as a gamer?*
b. *Do you ever play digital games?*
   i. *Would you say more or less than people of your age?*
c. *Do you like digital games?*
   i. *Why or why not?*
d. *Can you tell me about a time when you used a digital game-based material in your classroom?*
e. *If I had been there with you on any occasion, what would I have seen?*
   i. *Tell me about what the students were doing?*
   ii. *Tell me about what you were doing?*
   iii. *Tell me about the student's reactions?*
f. *What was your opinion about the material?*
   i. *What did you like about it?*
   ii. *What did you not like about it?*
   iii. *Would you use it again? Why or why not?*
g. *From your perspective, what was your students' experience like?*
   i. *What was their opinion about it?*
   ii. *How could you tell?*
h. *What was frustrating or difficult about the experience?*
i. *What was easy about it?*
j. *How did you choose the material you used?*
k. *What characteristics about the material were important?*
l. *How did you use it? What did you use it for?*
m. *What were your goals or objectives of the lesson or activity?*
n. *How would you improve the experience the next time? What would you do differently?*

Those are all the questions I have for you today. Thank you very much for your time. Is there anything else you would like to say about the topics we have discussed today?

I will leave you my contact information in case you need it. Thank you again for participating in this interview.

APPENDIX E: DISTRICT APPROVAL

From: Liza McGarity <McGarityL@fortmillschools.org>
Sent: Tuesday, March 30, 2021 8:49 AM
To: Andrew Simpson <SimpsonA@fortmillschools.org>
Cc: Josh Burris <BurrisJ@fortmillschools.org>
Subject: Approval to Conduct Research

Mr. Simpson,

Good morning**!** Mr. Burris shared your email detailing the work you wish to conduct as a part of your doctoral program with USC. Dr. Epps has approved your request.

We sincerely wish you all the best**!**

Thank you,
Liza

Liza McGarity
Executive Director Human Resources
Fort Mill School District
803-548-2527

APPENDIX F: IRB APPROVAL

UNIVERSITY OF
SOUTH CAROLINA

OFFICE OF RESEARCH COMPLIANCE

INSTITUTIONAL REVIEW BOARD FOR HUMAN RESEARCH
DECLARATION of NOT RESEARCH

Andrew Simpson
1028 Bounty Ln
Tega Cay, SC 29708

Re: **Pro00110919**

Dear Mr. Andrew Simpson:

This is to certify that research study entitled ***Pursuing Perceptions: A Qualitative Inductive Analysis of Ease of Use, Usefulness, Relevance, Self-Efficacy, and Past Experiences to Describe Influences on Elementary Teachers' Acceptance of Digital Game-Based Educational Materials*** was reviewed on **5/6/2021** by the Office of Research Compliance, which is an administrative office that supports the University of South Carolina Institutional Review Board (USC IRB). The Office of Research Compliance, on behalf of the Institutional Review Board, has determined that the referenced research study is not subject to the Protection of Human Subject Regulations in accordance with the Code of Federal Regulations 45 CFR 46 et. seq.

No further oversight by the USC IRB is required. However, the investigator should inform the Office of Research Compliance prior to making any substantive changes in the research methods, as this may alter the status of the project and require another review.

If you have questions, contact Lisa M. Johnson at lisaj@mailbox.sc.edu or (803) 777-6670.

Sincerely,

Lisa M. Johnson
ORC Assistant Director and IRB Manager