GAME-BASED LEARNING: EXAMINING FACTORS THAT INFLUENCE K-12 CLASSROOM USAGE

by

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DEDICATION

This dissertation is dedicated to my wife Casey and my son Kyle. Thank you for being my biggest supporters as I worked through completion of this program.

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ABSTRACT

Video games have become a popular and accepted part of digital culture and are becoming more accepted as an engaging instructional tool in schools. Integration of games can help develop students' intrinsic motivation for learning and are a great way for teachers to incorporate student interests and make connections to the curriculum. Classroom usage of digital games is becoming more widespread, but prior research suggests that game-based learning is underutilized as a tool in the teacher toolbox. This study seeks to understand the factors that influence teachers' decisions to use or not use digital games in their classroom and make suggestions for convincing reluctant teachers to increase usage of game-based learning in the future.

This study uses a survey-based concurrent embedded research design. Participants in the study were 133 current K-12 educators in the United States. Quantitative data was analyzed using SPSS software and path analysis was used to determine the factors that influence a teacher's intention to use digital games and actual reported usage of digital games in the classroom. Open-ended responses were analyzed using a word frequency and theme-based approach.

Overall, the data shows that teachers are integrating digital games into their instruction, with 86% of teachers reporting usage of digital games at least once per week. Teacher perceptions, knowledge of games and teaching with games, and experiences with games were identified as factors influencing digital game usage in the classroom. Findings suggest that ongoing professional development opportunities for teachers can

positively affect teacher perceptions and help resistant teachers overcome perceived barriers and increase classroom usage of GBL.

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LIST OF ABBREVIATIONS

ACC	Acceptance of GBL
BI	Behavioral Intention to Use
COTS	Commercial Off-the-shelf Video Game
DGBL	Digital Game-based Learning
EOU	Ease of Use
ESA	Entertainment Software Association
EXP	Experiences with Games
GBL	Game-based Learning
GK	Game Knowledge
GPK	Game Pedagogical Knowledge
GPCK	Game Pedagogical Content Knowledge
ICT	Information and Communication Technologies
IT	Instructional Technology
KNOW	Knowledge of Games and Teaching with Games
PB	Perceived Barriers
PD	Professional Development
PU	Perceived Usefulness
TAM	Technology Acceptance Model
TK	Technological Knowledge

TP	Teacher Perceptions
US	United States

CHAPTER ONE: INTRODUCTION

Video games have grown in popularity and become a dominant part of digital culture (Muriel & Crawford, 2018). In 2020, the Entertainment Software Association (ESA) reported that there are over 214 million video game players in the United States, including both adults (64%) and children under the age of 18 (70%). This acceptance of digital games as a source of entertainment in the overall culture has led to questions about utilizing these digital games for educational purposes (Plass et al., 2015). The study of game usage in the classroom and its impact on learning has become increasingly prevalent in academic research (Gee, 2003; Hsu et al., 2013; Lee et al., 2016; Waarvik, 2019, Whitton, 2014). Developing students' intrinsic motivation for learning is one benefit to integration of games (Lee et al., 2016). Well-designed games also provide a continuous feedback loop for the student which is essential for learning and progressing through the game (Whitton, 2014).

There appears to be a disconnect between the capability of game-based learning (GBL) as an effective teaching practice and actual usage in the classroom. From 2012-2014, NMC Horizon reports predicted GBL and digital games as becoming a major force in educational technology (Johnson et al., 2014). However, according to the Horizon report, the use of games for learning has waned over the last several years. Alexander et al. (2019) described reasons for the downtrend, which included: games being a niche learning tool only being used in a few classrooms, declining Instructional Technology (IT) budgets, and the complexity of creating games for an educational context. Another

challenge is that new technologies can lead to changes in pedagogy, but that requires shifts in thinking and instructional practice for teachers to improve student learning effectively (CoSN, 2019). Digital games can be effective learning systems and teacher perceptions about GBL are generally positive (Bertram, 2020). However, perceived barriers to implementation may obstruct teachers' use of GBL in the classroom. Helping teachers develop their game knowledge and their game pedagogical knowledge will help prepare them to integrate GBL into their teaching successfully (Hsu et al., 2013; Waarvik, 2019).

The research presented in this dissertation explores the implementation of GBL in K-12 classrooms and teachers' perceptions about using digital games for learning, including perceived barriers to implementation. This study also explores relationships between factors that influence educators' decisions to implement games into classroom instruction.

Background of the Study

The idea for this study developed from a conversation between two teachers ten years ago. During this conversation about student engagement, one teacher said to the other, "We cannot compete with the video games!" (T.L. Pags, personal communication, 2011). The other teacher thought about that statement and wondered why educators would need to compete with video games rather than bring them into the classroom to help students enjoy learning. Perhaps, educators should be asking questions about how to use students' interests, such as video games, as a vehicle for learning instead. Incorporating student interests and making connections to the curriculum is beneficial for

educators because, “We should be looking for ways to take what they love and turn it into new skills. They will discover things they haven’t imagined yet!” (Haskell, 2017).

Researchers of GBL have written about the attributes of digital games and their benefits on student learning within classrooms. The inclusion of games into the classroom to support the academic curriculum and help improve student learning, motivation, and engagement, is becoming a more widely accepted understanding (Foster & Shah, 2020). Publications such as the National Educational Technology Plan (US Department of Education, 2017) and organizations such as the Council for Accreditation of Educator Preparation (CAEP, 2013) recognize the importance of utilizing technologies (like digital games) to help increase critical thinking, creativity, and authentic learning. Effective integration of video games into instruction has the potential to help transform classrooms into more student-centered learning environments (Watson et al., 2011).

Despite the potential benefits of GBL, not all educators regularly and effectively use games for learning in today’s classrooms. Studies have found that 55% of K-12 educators indicated they use digital games in their classroom at least once a week (Fishman et al., 2014; Takeuchi & Vaala, 2014). These studies would seem to suggest that GBL in the classrooms is starting to become more widespread. However, other studies would appear to suggest that the level of usage is less than adequate. Kenny and McDaniel (2011) described the rate of adoption of games in K-12 classrooms as slow. Denham et al. (2016) researched GBL with an emphasis on increasing usage. They found that ongoing professional development focused on proper integration of games into the curriculum is important for increasing game usage. Another study by de Freitas (2018) suggests that there is resistance to adopting game-based approaches in educational

institutions. While there is evidence that a slim majority of educators use games in their classroom regularly (at least once per week), there appears to be many researchers who still feel educators underutilize games. My study contributes to the existing research and brings some clarity to these conflicting views by examining the perceptions, knowledge, and reported usage of K-12 educators regarding GBL.

Prior studies have developed and measured teachers' knowledge of GBL and the pedagogy of teaching with games. Many of these studies involved pre-service teachers (Foster & Shah, 2020; Hsu et al., 2015; Kennedy-Clark et al., 2011). Studies have also examined teachers' perceptions of games and their game pedagogical content knowledge (Baek, 2008; Hsu et al., 2015; Hsu et al., 2017; Hsu et al., 2020), several of which concentrated on areas outside of the United States (Baek (2008); Hsu et al., 2015; Hsu et al., 2017; Hsu et al., 2020; Watson & Yang, 2016). There is currently a gap in the available research examining current K-12 educators in the United States and their perceptions, knowledge, and usage of GBL. This study hopes to contribute to existing literature and fill a gap in the currently available research examining current K-12 educators in the United States and their perceptions, knowledge, and usage of GBL.

Purpose of the Study and Research Questions

The purpose of this study is to examine teachers' perceptions of game-based learning and understand why K-12 teachers use or do not use games as part of their classroom instruction. Based on the findings, I make suggestions for how reluctant teachers can be persuaded to use digital games in their classroom. Table 1 below details the purposes of this study and related research questions.

Table 1 Table of Purposes of the Study and Related Research Questions

RESEARCH QUESTION(S)	PURPOSE
What are teachers' experiences with implementing digital games in their classrooms?	Examine teachers' perceptions and attitudes towards game-based learning (GBL)
What factors influence teachers' classroom usage of digital games for learning?	Understand the reasons why teachers in K-12 classrooms use or do not use games as part of their instruction
What effect does professional development have on factors that influence teachers' usage of GBL?	Explore the impact of prior experiences with games and professional development on GBL usage in the classroom
What effect does prior experience teaching with games have on the factors that influence teachers' usage of GBL?	Explore the impact of prior experiences with games and professional development on GBL usage in the classroom
	Based on the findings, make suggestions for how more reluctant teachers could be convinced to use game-based learning in their classrooms

Significance of the Study

This study is significant because it provides insight into game-based learning, which is still a relatively new teaching method compared to more traditional pedagogies. This study discusses game usage in learning and how it can be improved by highlighting frameworks and methods that lead to successful integration in the classroom. The research analyzes teachers' actual technology usage, as studies incorporating GBL and actual usage are rare (Chai et al., 2013).

It is crucial to examine educators' perceptions about GBL and continue to add to the literature on the topic. Understanding teacher perceptions about GBL is important because their perceptions about using games in the classroom may impact their actual implementation. Research is needed to understand what barriers teachers may face (or think they will face) when implementing GBL (Watson & Yang, 2016). Identifying these barriers and ways to overcome them may help better prepare teachers for implementation of GBL, and thus may impact students' learning, engagement, and motivation.

Rationale for Methodology

This study uses a survey-based concurrent embedded strategy research design. With this type of design, data collection which is primarily quantitative data also collects qualitative data that serves in a supporting role (Creswell, 2009). In this study, survey data was collected from Likert-scale questions and analyzed to identify teacher's perceptions about game-based learning. Qualitative data collected in this study was in the form of open-ended survey question responses which was analyzed to extract themes and important ideas that the teachers shared. The reason for collecting both qualitative and quantitative data was to get a more in-depth understanding of their perceptions of GBL

and usage of games for learning in the classroom than may be obtained from either type of data separately (Creswell & Plano Clark, 2011). In this design, the qualitative data is embedded within the predominant quantitative method and the goal is to integrate the information and compare the two sources within the discussion chapter of this dissertation.

Assumptions of the Study

The study was conducted online utilizing surveys for data collection. I operated under the assumption that the survey respondents are currently practicing K-12 educators. The author attempted to limit the possibilities of any respondents outside of the target population by sending survey links to educators with current and valid school email addresses. Survey links were also sent to educators participating in graduate education programs. Since I used self-reported survey data, there was an assumption that the participant responses were truthful and accurate to the best of their knowledge. Lastly, there was an assumption that the survey questions created measured the knowledge intended, including teacher acceptance of GBL, teacher perceptions of its usefulness and barriers to implementation, their knowledge of games integration and how often they have used games in classroom instruction. This assumption is supported as much as possible with academic research, statistical procedures, and the reliability and validity of the measures they were adapted from. These items are discussed in the following chapters.

Chapter One Summary

Research about game-based learning (GBL) and the impact of games in the classroom has become increasingly evident (Gee, 2003; Hsu et al., 2013; Lee et al., 2016;

Waarvik, 2019; Whitton, 2014). The popularity of digital games as a source of entertainment in the overall culture has led researchers and educators to explore how to best use digital games for educational purposes (Plass et al., 2015). Digital games can be effective learning systems (Johnson et al., 2014) but are still a relatively new technology that requires shifts in thinking and professional learning to effectively lead to improved student learning (Easterling, 2021). There is currently a gap in the research examining current K-12 educators in the United States and their perceptions, knowledge, and usage of GBL. This study will examine teachers' attitudes towards and acceptance of GBL, their perceptions of the usefulness of GBL, perceived barriers to implementation of GBL, their knowledge of and experiences with GBL, and how teachers can overcome their perceived barriers of GBL leading to more successful integration and actual classroom usage.

Chapter Two of this dissertation provides an overview of related literature, focusing on digital games, game-based learning, teacher perceptions of GBL, perceived barriers to implementation, and the Technology Acceptance Model (TAM) framework.

CHAPTER TWO: LITERATURE REVIEW

In this chapter, I describe current literature on the following topics: defining game-based learning and the benefits of its use as a classroom learning tool, teacher acceptance of GBL as a learning tool, teacher perceptions about the usefulness of game-based learning, perceptions about perceived barriers to implementation, teachers knowledge about games and teaching with games, and other factors that may influence an educator's decision to implement GBL such as prior experience and professional development. This literature review aims to contextualize the study and show how it fits within the current research within the field. This literature review also lends credibility to the frameworks and factors I use in the study.

Game-Based Learning: Definition and Benefits

Games are structured forms of play to introduce a goal (Boller & Kapp, 2017). For this study, the author will be referring to a game by a definition developed by Boller and Kapp (2017):

> A game is an activity that has a goal, a challenge(s), and rules that guide the achievement of the goal; interactivity with either other players or the game environment (or both); and feedback mechanisms that give clear cues as to how well or poorly you are performing. It results in a quantifiable outcome that usually generates an emotional reaction in players (Boller & Kapp, 2017, p. 3).

Digital games are designed multimedia experiences that students play by interacting with an interface on some digital device (Huizenga et al., 2017). Players

receive feedback in a game based on their actions, and they can respond to that feedback via their gameplay decisions (Waarvik, 2019). Digital games provide players with authentic contexts, meaningful challenges, engagement, and rewarding experiences (Whitton, 2014). Games can provide safe environments within which players can take risks and explore as they work to overcome the challenges and conflicts presented within the gameplay (Prensky, 2001).

Games are integrated into learning experiences, whether in a classroom or other learning spaces and connected to learning standards or objectives (Gerber and Price, 2013). Quian and Clark (2016) describe GBL as "an environment where game content and gameplay enhance knowledge and skills acquisition, and where game activities involve problem-solving spaces and challenges that provide players/learners with a sense of achievement" (p. 51). Digital game-based learning (DGBL) refers to computer games or video games for teaching educational concepts and engaging learners (Tsai et al., 2016). There are different approaches to game-based learning that educators may consider for integration into instruction, including educational games, serious games, commercial-off-the-shelf games (COTS), and game design (Wu, 2015).

Teachers observed that when using games in their classroom, their students displayed increased enthusiasm, higher levels of engagement, perseverance, and the willingness to invest time in playing or creating games (Huizenga et al., 2017). Other benefits include providing opportunities for student conversation and asking questions, which can contribute to student learning. Thirty-six percent of teachers in the study conducted by Takeuchi and Vaala (2014) rated games improving social skills as ineffective or not applicable to their teaching area. Their findings seem to contradict the

ESA data showing the number of players who play games with others (65% of players and 55% of parents who play with their children) and play for the connection to others and sense of belonging (ESA, 2020).

Both traditional and digital games can help move the focus of schools "to more active, experimental, and student-centered models of teaching, learning, and assessment" (Whitton, 2014, p. 3). While using games may not be appropriate in every learning situation, games in the classroom can help facilitate learning and provide meaningful and engaging learning experiences. The following section will discuss some of the benefits of game-based learning found in existing literature, including student motivation, engagement, feedback, and experiential learning.

GBL and Student Motivation

Motivation is the desire to do something (Makulski, 2019). Motivation can be either intrinsic (i.e., internal—a person does something because they want to do it) or extrinsic (i.e., external—a person does something to please someone else, get recognition, or avoid consequences). Digital games have demonstrated the ability to keep players motivated to engage in gameplay for long periods (Granic et al., 2014). There are features designed within games that can be naturally motivating, such as rewards like points, badges, and trophies, in addition to engaging game mechanics that keep students interested and want to keep playing (Plass et al., 2015). Students who are intrinsically motivated to complete a classroom learning activity will feel the autonomy and desire to fully engage with and continue participating in that activity (Lee et al., 2016). Games also provide opportunities to engage learners in a task or activity. How engagement looks to an observer may differ depending on the individual learner, their specific learning goals,

and the setting or environment where the learning is taking place (Plass et al., 2015). According to Whitton (2014), factors that can contribute to sustained engagement include challenge, control, immersion, interest, and purpose. The more each of those factors exists in a scenario will lead to higher levels of engagement.

GBL and Active Learning

Using games in the classroom provides opportunities to engage students in active learning leading to increased student interest, collaboration and application of the ideas being taught (Reuben, 1999). According to Martyn (2007), better learning outcomes result from focusing on active rather than passive learning. Feedback is also an integral part of learning and motivation and a fundamental aspect of the design of digital games (Prensky, 2001; Whitton, 2014). The learner completes a task or activity, receives evaluation and feedback, and the learner reacts based on that feedback to modify their behavior or gameplay accordingly (Pivec & Kearney, 2007). Technology allows for the increased automaticity of the feedback cycle allowing for promptly delivering customizable feedback to the learner promptly. In the context of a game, players interact with the game and complete actions which generate feedback provided through the game's interface. When the feedback is received, the players can respond to the feedback received through action and continue to progress through the game. This feedback cycle "is essential to the process of learning and the fact that a game can make this implicit within the virtual gaming world, situating feedback seamlessly within the game, makes it an incredibly powerful learning tool" (Whitton, 2014, p. 148). The automated environments of digital games make them effective at providing feedback, unlike a board or card game. Continuous feedback provided as students advance through a task can

sometimes be immediate and other times delayed, which allows for options when designing games to include feedback at appropriate times. Immediate feedback allows for increased conceptual knowledge, correction of errors in real-time, and providing a safety net for complex tasks (Shute, 2008). Delayed feedback can allow for better transfer of learning and is appropriate for more straightforward tasks. Students may know what they are doing and possibly view the feedback at certain times as an annoyance.

GBL and Experiential Learning

Digital games can reimagine experiences and provide safe environments to play, explore, and gain knowledge. They also provide an environment where making mistakes and failure is accepted and seen as part of the learning process (Whitton, 2014). Traditional learning experiences have seen failure portrayed as a negative experience that comes with consequences, whether it be a failing grade, work marked up with a red, or a trip to the principal's office. In digital games, failure, practice, and repetition are positives and part of the learning process (Whitton, 2014). Game-based learning experiences and those using other digital technologies (e.g., blogs, discussion boards, peer response tools) can provide a safe space for learners to make mistakes as part of the learning process without having real-world consequences. Learning and interacting with virtual environments like *Minecraft: Education Edition* can allow students to apply knowledge in authentic contexts, which can help transfer learning (Baek, 2009). Digital games are important contexts for experiential learning because of their "ability to represent authentic contexts that for practical reasons would be too costly, dangerous, irresponsible, or impossible for learners to experience in any other way" (Waarvik, 2019, p. 29).

Researchers have discovered many benefits to integrating game-based learning into classroom instruction. Features designed within games can motivate students and help improve their desire to learn. Feedback cycles that occur during gameplay are essential parts of the learning process. Games and virtual environments can provide authentic contexts for students to apply what they have learned and demonstrate understanding. Educators who see the value of integrating digital games and the benefits to student learning may be more likely to integrate them in their classrooms. The following section will discuss factors that influence educators' usage of GBL for instruction.

Factors Affecting Educator Decisions to Implement GBL

Understanding the potential benefits of digital games as instructional tools is an essential contribution to research on game-based learning. However, it is also essential to understand the factors affecting educators' decisions to implement GBL. If an educator is adopting something new to use in their classroom, that something new will likely be replacing something else. Therefore, the educator needs to perceive the innovation of digital games as having value and providing them with an advantage by choosing to implement them in their classroom (Waarvik, 2019). Educators must perceive using digital games and the effort to learn something new as worth the time and energy over their current practices. If they perceive the implementation of digital games to be too difficult or do not see the value, they may be less likely to adopt and implement with their students (Davis, 1989; Waarvik, 2019). The following sections of the literature review will explore four factors that may influence a teacher's decision to use GBL in their classroom: (a) teacher acceptance of GBL as an instructional tool, (b) teacher perceptions of GBL, (c) teacher perceived barriers to implementation, and (d) teacher game-based

technological pedagogical content knowledge. In addition, the author explores the factors of prior experiences with games and GBL professional development which may affect those four factors and lead to increased classroom usage.

Teacher Acceptance of GBL as an Instructional Tool

Teacher acceptance of GBL as an instructional tool can be measured with an existing research model of technology acceptance. Davis (1989) developed the Technology Acceptance Model (TAM) to help explain if potential users of the technology will decide to use it. This model uses two constructs, perceived usefulness, and perceived ease of use. Perceived usefulness is the degree that an educator perceives that using technology will help improve their instruction (Idris et al., 2015). Perceived ease of use is the degree to which an educator believes adopting new technology would be free of physical and mental effort. Davis (1989) suggests that if these two constructs outweigh the potential difficulty of adopting the technology, there is a greater likelihood of technology adoption. Perceived ease of use is also a factor that affects the perceived usefulness of a tool. Davis' TAM model is like self-efficacy theory which suggests that people's perceived skills, competence related to the task ahead, and perceived value of completing the task influence their actions (Waarvik, 2019). If an educator finds a technology too challenging to learn or implement, does not see the value or clear connections to the curriculum, they will not use it (Ketelhut & Schifter, 2010).

In Davis' (1989) model, *Perceived Usefulness and Perceived Ease of Use* directly affect a person's attitude towards using technology. Attitude or acceptance of the tool and perceived usefulness directly affect intent to adopt and use the technology. The figure below illustrates the TAM model (Figure 1).

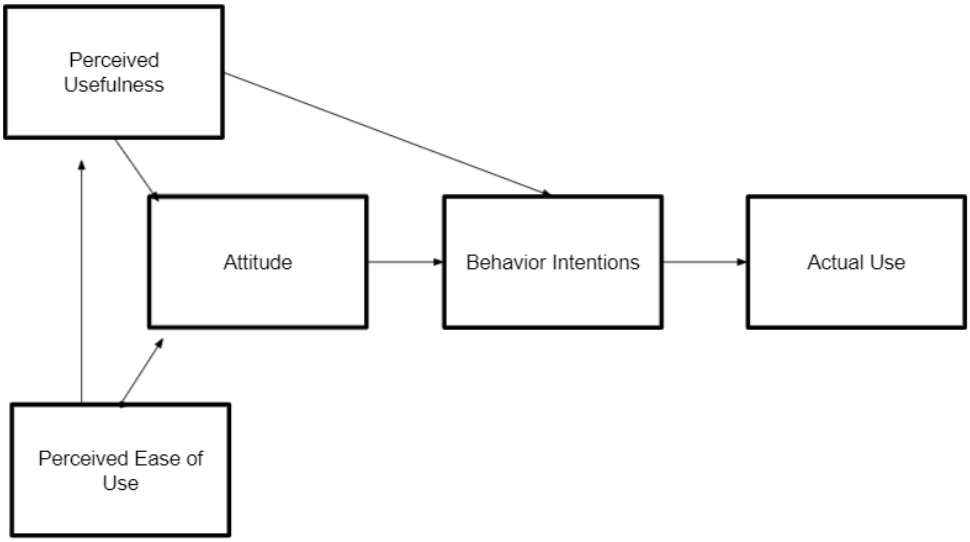


Figure 1 TAM Model

The original TAM model (Davis, 1989) has since been tweaked by other researchers to determine acceptance of various emerging technologies. Bourgonjon et al. (2010) adapted the TAM model to focus on student preferences towards digital games in the classroom. They kept the factors of *Usefulness* and *Ease of Use* in their model. However, they made changes to fit the context of their study, including using a *Preference for Learning Games* as the dependent variable instead of *Intention to Use*. The study results showed that all factors involved were statistically significant and accounted for 63% of the variance in preference for digital learning games, which is an increase of explained variance when compared to the original TAM model. The study focused on student acceptance of digital games, but with some adaptation, the model can focus on teacher acceptance. My study was consistent with literature that suggests the TAM model can be made more potent by adapting it to a specific context (Waarvik, 2019). A variation of Bourgonjon et al.'s (2010) model can help determine the relationship between teacher acceptance of GBL and actual usage in their classroom.

Wang and Goh (2017) analyzed 50 peer-reviewed articles that studied digital games along with elements of the TAM model. In this study, Wang and Goh separated games played for pleasure and games played for practical purposes. Only 15 of the 50 studies focused on games for practical purposes. In addition to the constructs of perceived usefulness and perceived ease of use, they measured the effects of attitude, perceived enjoyment, and satisfaction on the behavioral intention to use digital games. Only eight of the 50 studies analyzed measured actual usage. Perceived ease of use and perceived usefulness showed higher effects on games played for practical purposes, with ease of use being the most critical factor. The study results showed that TAM-based studies into digital games varied depending on the game's purpose and the type of respondents playing the games.

Shen and Eder (2009) studied the behavioral intention of undergraduate business students to continue using the virtual game Second Life after completing their course. Their results showed that self-efficacy and playfulness impacted the perceived ease of use. Perceived usefulness was a statistically significant factor in the students' continued use of the game as a platform for learning. Chen et al. (2018) found similar results in a study of elderly adults and their use of exercise and cognitive games. They found perceived usefulness to be a statistically significant factor in the behavioral intention to use games for learning, but perceived ease of use did not significantly impact either perceived usefulness or intent to use. Adult learners may be the most impacted learners regarding perceived usefulness affecting their decision to use games for practical purposes such as teaching and learning (Waarvik, 2019).

The TAM model is a powerful model for predicting educators' intention to use technologies in their classrooms. Perceived usefulness is a primary indicator that affects teachers' actual usage of games in the classroom (Waarvik, 2019). However, research on this topic has mostly focused on pre-service teachers' intentions who have not had the opportunity to implement this technology. This study focused on in-service teachers and their actual usage of GBL to determine how ease of use and perceived usefulness affect an educator's acceptance of GBL and leads to implementation.

Teacher Perceptions of Game-Based Learning

The use of game-based learning and games in the classroom can motivate and engage students, but what are the educators' perceptions and understandings of the benefits of using games for learning? Learning how teachers perceive video games as an instructional tool "will help researchers better understand ways to structure games-based learning in classroom environments" (Gerber & Price, 2013, p. 51). Teacher perceptions are also important because they are the ones who will be determining if they will use games as part of their instruction as well as evaluating and selecting which games to use for learning. Having insight into their perceptions of the benefits of using games for learning can help provide teachers with a better understanding of their decisions to use GBL as part of their instructional practice (Huizenga et al., 2017).

Even though the implementation of learning games may vary in different classrooms, many teachers perceive game-based learning as having value for improving student motivation, problem-solving, acquiring knowledge, and cognitive skills. Teachers also perceive benefits of GBL integration to include providing student creativity and collaboration opportunities (Allsop & Jessel, 2018). Many teachers also perceive positive

effects of GBL on student learning due to the presence of the following elements: a) learning in a safe environment; b) direct and timely feedback from their actions in the game; c) active learning and discovery; and d) visualization of processes (e.g., seeing how cell division works) (Huizenga et al., 2017). Takeuchi and Valla (2014) surveyed 694 educators regarding their perceptions of digital games and how effective they were in improving student learning. Fifty-five percent of game-using educators saw benefits for low-performing students and learners with special needs. Other results showed that 58% believed digital game use leads to higher attendance, and 49% disagreed that using games in the classroom would lead to behavioral issues.

Teachers who use digital games seek curriculum connections and use games to instruct and assess students on that content. Gerber and Price (2013) conducted a study with educators where they played a commercial off-the-shelf video game (COTS) to completion while researching literacy contexts and activities related to the game they were playing, including blogs, walkthroughs, and fanfiction. The literacy components of the course resonated with the teachers as they were able to make connections to traditional literacy practices as they imagined engaging their students in learning. As a result, they were able to see the value of gaming as a literacy experience. In a related study, 71% of teachers who used games in their classrooms reported that digital games were either effective or highly effective in improving their students' learning in mathematics. Fifty-six percent of educators also reported digital games being effective or highly effective in students' literacy learning (Takeuchi & Vaala, 2014).

One aspect of teachers increasing their knowledge and perceptions of GBL can come from engaging in the game design process. An and Cao (2017) explored conceptual

game design experiences with a study involving 50 teachers enrolled in two sections of an online graduate course. The teachers learned how to design their games by reading articles about well-designed games, completing a game design document, and receiving peer feedback. The study's findings showed that the game design experience "had a positive influence on the participants' attitudes toward the use of digital games in teaching" (p. 165). Participants noted that the game design assignment helped change their perception of digital games, and they were now more interested in using them in their classrooms. They had a new appreciation for the 21st-century skills that students could develop while designing games. Participants in other research studies have also noted that teachers should be involved in the process of educational game design (An, 2018).

One component that may impact teachers' perceptions about game-based learning is professional development to help them learn and become more comfortable with GBL integration. Denham et al. (2016) studied and found underutilization of classroom learning games, and there were not many professional development opportunities to help train educators on how to integrate learning games. A study conducted by An (2018) examined the effects of a graduate professional development course on teachers' perceptions and attitudes towards the use of games in the classroom for learning. Results of the study showed a positive influence on the teachers' perceptions of the benefits of digital games in the classroom. At the end of the study, most participants (85.7%) indicated they would use digital games in their classroom and planned to help other teachers integrate game-based learning. The study's findings suggest that there are benefits to providing educators with professional learning instruction and resources to

help them build their knowledge, confidence, and comfort level with the implementation of game-based learning.

Perceived Barriers to Implementation

While teachers often perceive positive benefits of the integration of GBL into their classroom, they also report various barriers that may hinder or obstruct them from implementing GBL. Perceived barriers include both internal and external factors. Internal barriers would be those perceived to be related to the teachers themselves, either their lack of knowledge of successful implementation of game-based learning or their attitudes regarding the benefits of using GBL as part of their instruction. External barriers would be those perceived to be beyond the teachers' immediate control, such as school and district budgets, curriculum requirements, and time available due to fixed class schedules (Wu, 2015). Watson and Yang (2016) conducted a study of K-12 teachers in the United States (US) and their perceptions of the barriers to implementation of GBL they had encountered. Difficulties with managing a class playing a game, inadequate classroom technology, and lack of funds and support for teachers were common barriers among many of the teachers in the study.

Baek (2008) conducted a similar study in which he explored barriers to educators' use of games in the classroom. The results of his survey indicated that six common factors were barriers to educators' use of games in the classroom: Inflexibility of the curriculum, adverse effects of gaming, student preparedness, lack of supporting materials (including limited funding), and fixed class schedules. Baek (2008) noted that generational differences could also impact the different attitudes between experienced and inexperienced teachers. Experienced teachers identified inflexibility in the

curriculum and adverse effects of gaming as serious obstacles. Lack of supporting materials and fixed class schedules were less of an issue for inexperienced teachers. Student readiness for learning was an exciting factor mentioned in this study and something essential for educators to consider when designing a lesson utilizing game-based learning.

Teachers' own prior experiences with games and their perceptions about the benefits of use in the classroom can provide another barrier to GBL implementation. An et al. (2016) conducted a study with science teachers in Georgia in which they found that 4.5% of teachers were against the use of computer games in the classroom, and 11% reported they had no desire to use classroom time for computer games. Those teachers may be less likely to adopt and use games in their classroom instruction. They may benefit from increased awareness and knowledge about the successes of GBL implementation and strategies for getting started and finding resources for support. These supports and resources can be developed and made available, but "the teacher must be willing to use games in the classroom" (Koh et al., 2012, p. 59).

Survey results from An et al.'s (2016) study showed several barriers to integrating computer games into the classroom, as reported by teachers. These barriers included "lack of computers (70%), lack of time (49%), time needed for preparation for school and national high-stakes testing (27%), lack of knowledge about science games (27%), and a lack of technology support within schools (24%)" (p. 427). The study also identified school culture, lack of technology skills, lack of knowledge about integrating educational computer games, and limitations in the school schedule as barriers to implementation to a lesser degree (An et al., 2016).

Primary school educators teaching Malay history indicated insufficient time for implementation, lack of teacher knowledge about implementing digital GBL, and short lesson periods as major obstacles to implementing GBL in their classrooms (Wong & Ghavifekr, 2018). Teachers' short lesson periods with their students and the required curriculum may lend themselves to implementing some shorter game experiences. However, it can be difficult for educators to integrate a more immersive and more extended digital game experience (Mokhsin et al., 2019). Teachers in a game-based literacy learning study identified a lack of resources with limited budgets, fear of changing existing mandated curriculum requirements, and fear of how their colleagues might perceive them as barriers to GBL implementation (Gerber & Price, 2013). These perceived barriers were consistent with perceptions of teachers in other studies.

Teacher Knowledge of Games and Teaching with Games

Researchers have studied the integration of games into classrooms and the relation to teachers' knowledge about games. Kennedy-Clark et al. (2011) examined pre-service educators' attitudes towards games and developed a unit of study where they integrated games within the context of the TPACK framework. The study results showed statistically significant improvement in the pre-service teachers' knowledge and confidence in utilizing information and communication technologies (ICT) in their classrooms. Sancar Tokmak and Ozgelen (2013) conducted a similar study with pre-service educators to learn about game integration with activities designed utilizing the TPACK framework. The researchers found that pre-service educators perceived existing games as restrictive regarding the content they could teach and how they could use games

to enhance learning. The study's course environment allowed the pre-service teachers to learn from others and think about their game integration from different perspectives.

Sancar Tokmak (2015) took another TPACK and game design approach to increase the knowledge of the educators designing the games. Pre-service teachers designed an instructional game for elementary school students and measured their knowledge development in the study. The results showed that the educators used the TPACK framework to design their games and showed growth in their technological knowledge as they learned how to use the programs used to design their games.

Gerber and Price (2013) found that "teachers do not have to have the in-depth understanding of video games, or knowledge of multiple video game genres, to create lessons that use video games as a platform for literacy activities" (p. 59). While it may not be a barrier to entry, teachers may benefit from professional learning to further develop their knowledge of games and provide them with instruction and resources to help their confidence and comfort level with GBL implementation in their classroom (An, 2018).

Hsu, Liang, and Su (2015) conducted a study to explore educator's GBL knowledge involving two groups of pre-school educators enrolled in a game integration course. The study results suggest that game knowledge (GK) is fundamental. If professional learning courses strive first to improve teachers' GK, that will better prepare them and improve the integration of digital games into their classrooms. Teachers who have knowledge and experience with digital games will know to draw from when designing learning experiences with their students. These findings are like those of Hsu et al. (2013), who concluded it was essential to develop GK as a prerequisite to the other

areas, and studies conducted previously by Baek (2008), Becker (2007), and Shaffer (2006), which stressed the importance of developing educators' technological knowledge (TK) first before other knowledge areas such as pedagogical or content knowledge.

Hsu, Liang, and Su(2015) conducted a study with in-service pre-school teachers enrolled in a course about children's health care designed with the TPACK-G framework. This study had a similar design to the one conducted by Hsu et al. (2013) because one group focused first on pedagogical knowledge, and the other focused on game knowledge first. The results were also similar in that researchers found that the game knowledge (GK) group participants scored higher on their GPK and GPCK scores. They concluded that instructing the participants on game knowledge first allowed them to learn more about games, how they worked, and how they can apply to classroom instruction. This instruction led to participants applying their knowledge in the later stages of the study and improved their overall knowledge about teaching with games (Hsu et al., 2015).

Hsu et al. (2017) examined the perceived confidence levels of educators regarding the implementation of GBL. They used the TPACK-G framework and another model, the Game-based learning Teaching Belief Scale (GTBS). GTBS, adapted from the work of Chang and Tsai (2014), measures the beliefs, confidence, and motivation towards game-based learning. The study results found that educators' game pedagogical knowledge had a significant impact on their game pedagogical content knowledge (GPCK), with a variance of 73%. These findings align with prior studies that motivation, confidence, and game knowledge are predictors of GPCK. While both groups of participants showed positive impacts, elementary school teachers had more belief, confidence, motivation, GPK, and GPCK than their middle school counterparts. Fishman et al.'s (2014) research

results also suggested that elementary school teachers were more likely to use games for instruction than secondary teachers. Hsu et al. (2017) concluded that while game knowledge (GK) should come before the other knowledge areas, it is the game knowledge in combination with the educators' pedagogical knowledge (GPK) that is the most statistically significant factor in predicting their overall GPCK. This study's findings suggest that professional development courses designed with TPACK in mind should include activities that help teachers develop their GK and GPK knowledge and skills.

Waarvik (2019) conducted a survey-based study where the TPACK-G framework was incorporated as part of the study and evaluated the relationship between TPACK-G and the actual usage of digital games in the classroom. The findings showed that game pedagogical knowledge (GPK) was the most influential factor in predicting the usage of game-based learning, which was also found in research by Hsu et al. (2017). Waarvik (2019) recommended that a more helpful approach to professional development sessions for educators would be to focus more on the specific attributes of digital games that make them great learning tools and how digital games align with different pedagogical methods. He suggests focusing less on specific games, technological knowledge, or how digital games fit within the curriculum. In addition, increased game pedagogical knowledge might help educators overcome some of the perceived barriers to GBL implementation.

What do educators' perceptions of their game-based knowledge indicate about their attitudes towards games and actual usage in the classroom? Hsu et al. (2020) conducted a study with 376 in-service elementary school teachers in Taiwan to examine

their confidence in their TPACK-G knowledge and their attitudes towards game-based learning and related teaching usage. The study's findings indicated GK was a positive predictor of their GCK and GPK, and both of those positively predicted their GPCK. In addition, the junior elementary school teachers were significantly higher in their perception of their game-based knowledge than the senior elementary school teachers. These findings correlate with the Hsu et al.'s (2017) study, which found the novice teachers demonstrated higher confidence in their game-based knowledge levels than experienced teachers. Fishman et al. (2014) argued that an educator's age does not impact which educators used games in their classroom, and strategies targeting older educators may not be practical. They suggest that even if an older educator does not perceive their confidence or knowledge about games to be high, they may still be willing to integrate games into their classroom instruction. This suggests that professional development about game-based learning should focus on how successful implementation of games can improve an educator's GPK. The study also found that there may be a need to increase teachers' knowledge of digital games that are well-designed for implementation in the classroom (Hsu et al., 2020).

Experiences with Games

Another factor that may influence GBL usage in the classroom is the experiences with games of the educators themselves. This research considers an educator's gaming profile, which consists of their personal experience with games, age and gender, and the current teaching role (subject/grade level taught). This discussion will include two types of educators, gamers and those who use games for learning.

Gamers

One demographic factor to consider is whether experience with games can influence the decision to adopt GBL for use in the classroom. This paper explores the factor of experience with games in a couple of ways: (a) the self-identification of an educator as a "gamer" and (b) experiences playing games outside the classroom environment. Identifying oneself as a gamer is complicated than just someone who plays games. The term "gamer" is an evolving term that refers to a "multi-faceted social identity" that involves many factors (Grooten & Kowert, 2015, p. 83). Gamers go beyond just playing or interacting with games but invest time and self-identify as members of a larger community of like-minded individuals and may describe or represent themselves during interactions outside of gameplay. Grooten and Kowert developed a model of gamer identification, which focuses on factors such as self-identification, communities that gamers participate in, social influences, and existing stereotypes (Waarvik, 2019). For this study, the author categorizes educators as gamers through their self-identification.

What benefits may being a gamer have for those educators concerning the implementation of GBL in the classroom? Educators who identify themselves as gamers may have more knowledge of games and see their value and may be more likely to be early adopters of using games for instructional purposes (Rogers, 2003). Knowing games themselves does not necessarily mean they know how to implement games into instruction. However, because they are interested in games, they may be more likely to expose themselves to different games and learn how to integrate them into their lessons. Educators who consider themselves gamers may also have a more positive perception

about games and their usefulness, which may or may not translate to perceptions about using games for learning in the classroom. Lastly, gamers are likely to be more familiar with digital games, so they may not perceive games as too complex, which may impact their acceptance and potentially lead to the adoption of digital games as a tool for instruction (Rogers, 2003; Waarvik, 2019).

Educators perceiving themselves as gamers may impact the factors leading to the implementation of game-based learning. Educators may accept the potential of GBL in the classroom since they are already familiar with and have positive attitudes towards games and their usefulness. They may have positive perceptions of using games in the classroom since they already enjoy playing games outside of the classroom. Gamer educators may not impact any external barriers to GBL implementation since those types of barriers are out of their control. However, their interest in games may motivate them to be willing to work to overcome those barriers. Lastly, their existing knowledge and interest in games may impact their willingness to learn and improve the other areas of their TPACK-G knowledge to become proficient at integrating games for learning in the classroom.

Game-Using Educators

Many educators do not classify themselves as gamers but who do used games as part of their instruction. Researchers have analyzed digital game usage by educators and categorized them into different categories based on usage, experience, and other demographic factors. One study conducted by Takeuchi and Vaala (2014) focused on K-8 educators in the United States. The results of a cluster analysis allowed the researchers to categorize the educators into four recognizable categories, which focused on the factors

of: (a)frequency of play, (b)frequency of classroom usage, (c)comfort level with GBL integration, (d)barriers faced, (e)support from stakeholders, and (f)professional development received. The four categories defined by Takeuchi and Vaala were: (a) “The Dabblers,” (b) “The Players,” (c) “The Barrier Busters,” and (d) “The Naturals.”

The first group of educators categorized by Takeuchi and Vaala (2014) was “the dabblers.” These educators did use games as part of their instruction but did so less often than their peers in other groups and indicated some level of discomfort with doing so. Dabblers reported several barriers to implementation, had moderate support from stakeholders, and accessed very few professional development resources regarding game integration into classroom instruction. The second group of educators categorized was known as “the players.” These are educators that play many games for recreation but were also the least likely group to teach with games and reported the lowest levels of usage, support, comfort level, and the highest reported barriers in the study. These results lend to the idea that experience with playing games alone does not translate to being prepared to teach using games. Takeuchi and Vaala called their third category “the barrier busters” because even though this group of educators reported high levels of barriers to implementation, they also reported high levels of classroom usage. High levels of barriers and classroom usage suggest that while barriers to implementation may exist, some are not insurmountable, and integrating games into the classroom is still possible under those circumstances. This group reported high comfort levels with using games and the highest reporting of professional development resources accessed. The fourth and final group was called “the naturals.” The naturals reported playing games regularly, teaching with games regularly, high levels of comfort, community support, and accessing professional

development. Naturals also report low levels of barriers to implementation. Game-based learning integration is a very complex thing, as seen with the differences in groupings of educators in this study. The “barrier busters” group faced a high level of barriers to implementation but still managed to teach with games often. The responses may suggest their willingness to learn and put in the effort to seek out resources to help them overcome those barriers. Some educators who reported playing games frequently also reported that they do not teach with them often. Some educators who regularly play games and teach with games also reported low levels of accessing resources. The responses suggest perhaps that when researchers look at the experience factor should be focused on experience teaching with games as playing games alone may not be enough to translate to knowing how to teach with games.

Another large-scale survey of educators and their game-based learning practices was conducted by Fishman et al. in 2014. Their study comprised K-12 educators in the United States. Eighty-four percent of the teachers who participated reported being moderately comfortable or very comfortable using digital games as a teaching tool, and 57 percent of them use games at least weekly, suggesting experience using GBL. Very similar to Takeuchi and Vaala’s (2014) reporting, Fishman et al. completed a cluster analysis and grouped educators into four categories based on their responses and commonalities among certain variables. There were no statistically significant differences in age, gender, teaching experiences, subject area, or grade level taught between the groups. Their first category was the “enthusiastic game-using teacher” and comprised 18 percent of the teachers in the study. These teachers are likely to positively perceive the

efficacy of games for learning, use games more often, and report low levels of barriers to using games for formative assessment.

The second group categorized by Fishman et al. (2014) was the "frequent (but not for core content) game-using teacher" and consisted of 17 percent of the participants. The teachers in this group use games more frequently than others, but primarily for supplemental content and engagement. They also perceive games as adequate for various instructional purposes, but less so than the first group. These teachers are also more likely to check for motivation and engagement during formative assessment. Thirty-two percent of the participants fell into the next category of the "frequent, but not so enthusiastic game user." They use games more frequently for teaching mandatory core content but less so for assessment and teaching supplemental content. These teachers report they think games are adequate but to a lesser degree than the first two groups and are likely to report more barriers to using games for formative assessment. The last group is the "not-so-into games teacher" and was also 32 percent of the participants. The "not-so-into games teachers" use games less often, are less comfortable using games, report many barriers to implementation, and do not believe games are effective teaching tools for any purpose, especially teaching new content. The study's results suggest a correlation between teacher perceptions and acceptance of GBL and actual usage, as well as a connection between perceived barriers to implementation and actual usage.

The studies conducted by Takeuchi and Vaala (2014) and Fishman et al. (2014) suggest a correlation between prior experience with using games for teaching and impacts on the areas of acceptance of GBL, teacher perceptions of effectiveness, potential barriers for implementation, and knowledge, all which impact decisions to implement and actual

usage. The studies also found that prior experiences playing games alone did not necessarily lead to increased usage in the classroom or knowledge about how to teach with games. The next section of this literature review will look at professional development as a factor impacting decisions to use GBL as an instructional tool.

GBL Professional Development

Practical and valuable professional development (PD) is vital for educators to continue learning and developing pedagogy skills related to their teaching areas (Darling-Hammond et al., 2017). Hammond et al. consider effective PD to be structured PD that is focused, incorporates active learning, supports collaboration, uses models of effective practice, offers ongoing support and time for reflection. All those elements lead to changes in teacher practices and increases in student learning. Quality PD could also apply to effective professional development about game-based learning. This section of the literature review explores PD as a factor for increasing classroom usage of GBL.

Teachers play important roles when it comes to decisions about the integration of games into the classroom. If teachers are going to increase usage of games, providing them with professional development and resources may be paramount to increasing their knowledge and overcoming potential barriers they may perceive (Gresalfi et al., 2011). Developing teachers' skills and knowledge in game-based learning and providing ongoing support and resources can help limit factors that lead to the reluctance of integrating games as an instructional tool (Shah & Foster, 2015).

Kennedy-Clark et al. (2011) offered a workshop to pre-service teachers about integrating game-based learning into inquiry using the TPACK framework. Their study reported positive gains in teachers' perceived abilities to integrate digital games,

increases in their knowledge of games and virtual worlds, and positive changes in their perceptions about the use of educational games. Sardone and Devlin-Scherer (2010) had similar findings of teacher perceptions. They offered a course to pre-service teachers who could identify vital digital skills found in games, relate them to the content area they taught, and envision educational contexts to create learning experiences for their students. Shah and Foster (2015) analyzed a course offered to pre-service teachers about methods of adopting game-based learning. Only teachers interested in the topic registered for the course and had no prior experience, nor did they regularly play games. The study's results showed a significant increase in the participants' game-based knowledge and skills and empowered them to integrate game-based learning into a classroom setting effectively. Results from a Games Science and Identity PD course showed a significant difference in the teacher's knowledge of game analysis, game integration, and ecological conditions that may impact the success of GBL implementation (Shah & Foster, 2018). The findings of these studies show that effective professional development can lead to gains in teachers' skills and confidence about GBL integration, and how it is vital that teachers feel supported in their efforts to impact their choices to implement GBL into their classroom instruction (Shah & Foster, 2014).

Previous research on GBL has found that prior experiences playing games alone did not necessarily lead to increased usage in the classroom or knowledge about how to teach with games (Takeuchi & Vaala, 2014; Fishman et al., 2014). Even self-identified gamers and those educators who are comfortable and enjoy playing games on their own time do not necessarily have the skills and knowledge on how to effectively implement GBL as a teaching practice (Lei, 2009). While pre-service and in-service traditional PD

methods can be effective, are there additional sources for educators to turn to for professional learning about GBL? Takeuchi and Valla (2014) surveyed educators to determine where they most often find PD resources about integrating digital games. Participants shared how they first learned about using games in the classroom. Learning from another teacher (25-41%), figuring it out themselves (20-25%), and in-service PD (15-24% except for the 0–4 years of experience teachers) were the highest responses.

Regarding ongoing PD, most participants (68%) indicated they consulted fellow educators (fellow teacher, coach, or supervisor) to seek help integrating games. Other top resources identified were online discussion forums (25%) and video tutorials (23%). Fifteen percent of game-using educators noted they did not seek ongoing PD on digital games integration. These results suggest that traditional in-service (or pre-service) PD offerings are not the only method of providing ongoing PD for educators. Educators and districts should consider multiple flexible options for game-based learning PD.

Effective PD on game-based learning that is ongoing and gives teachers opportunities to implement can help with the adoption rate by alleviating the barriers teachers perceive and increasing their knowledge about the effectiveness and ways to implement games into their teaching successfully (Runciman, 2019). Professional development can directly impact the factors of acceptance of GBL as a pedagogical tool, positive perceptions about its effectiveness, bringing down barriers to implementation, and increasing game-based technological pedagogical content knowledge. Well-designed PD that provides educators with opportunities to practice implementation can also directly impact usage for in-service teachers.

Chapter Two Summary

Games provide learners with safe environments to explore and take risks as they engage in learning within authentic contexts, complete meaningful challenges, develop knowledge and skills, and experience a sense of achievement (Prensky, 2001; Quian and Clark, 2016; Whitton, 2014). This study aims to understand the factors that may influence an educator's decision to use games as an instructional tool in their classroom. Educators who perceive digital games as having value and as worth adopting will be more likely to implement them in their classrooms (Waarvik, 2019). If perceived usefulness and ease of use outweigh the potential difficulty of implementation, there is a greater likelihood of adopting the technology (Davis, 1989). Many teachers have positive perceptions about the value of game-based learning. They recognize benefits for their students that encourage and develop student motivation, problem-solving skills, acquisition of knowledge, cognitive skills, creativity, and collaboration (Allsop & Jessel, 2018).

While recognizing and believing in the benefits of GBL, researchers have found that teachers also believe several barriers get in the way of implementation, including lack of time, technology, funding, support and resources, and knowledge of best practices for successful implementation (An et al., 2016; Baek, 2008; Gerber & Price, 2013; Waarvik, 2019). Additional learning may overcome some of these barriers for the pre-service and in-service educators to increase their knowledge and awareness of best practices for implementation. Frameworks such as TPACK-G developed by Hsu et al. (2013) and models developed by Whitton (2007) and Bidarra et al. (2013) provide resources for designing professional development focused on GBL integration and for providing resources teachers can use to evaluate games to incorporate into their

classroom instruction. Teachers' prior experiences teaching with games and opportunities to learn more about games and practical implementation in a classroom setting can influence their acceptance, perceptions, and knowledge. Effective PD on GBL and increased opportunities for implementation can lead to increased classroom usage.

Chapter Three provides the research methodology, including specific information about the problem, research questions, research design, participants, data collection, ethical considerations, and limitations.

CHAPTER THREE: METHODOLOGY

In this chapter, I provide the research methodology, including (1) purposes of the study, (2) research questions and hypotheses, (3) research design, (4) participants and research context, (5) instrumentation, (6) data collection, (7) data analysis, (8) ethical considerations, and (9) limitations and delimitations.

The study has the following purposes:

1) Examine teachers' perceptions and attitudes towards game-based learning (GBL).
2) Understand the reasons why teachers in K-12 classrooms use or do not use games as part of their instruction.
3) Explore the impact of prior experiences with games and professional development on GBL usage in the classroom.
4) Based on the findings, make suggestions for how more reluctant teachers could be convinced to use game-based learning in their classrooms.

Integration of games in the classroom is becoming more widely accepted as a learning tool as educators recognize the ability of GBL to connect to the curriculum, engage and motivate students, and help improve student learning (Foster & Shah, 2020). Effective integration of video games into instruction can help transform classrooms into more engaging, student-centered learning environments (Watson et al., 2011). Despite all the potential benefits, educators are underutilizing games in classroom instruction

(Denham et al., 2016; Kenny & McDaniel, 2011). Though utilization varies, few educators are using games in their classrooms more than once per week (Fishman et al., 2014; Takeuchi & Vaala, 2014). The lack of GBL usage may be due to teachers' experiences and general perceptions of games and their perceptions of the educational potential of games (Hsu et al., 2013). Through this study, I hope to contribute to existing research and bring some clarity to the conflicting views.

In this study, I used a survey based concurrent embedded design (Creswell, 2009). I collected quantitative and qualitative data from participants via the completion of a survey containing Likert scale and open-ended questions. Collecting both types of data provides a more nuanced understanding of the research problem and the factors that influence the implementation and usage of games in the classroom. The study focused on current K-12 educators in the United States, collecting data such as demographics, gaming experience and teacher acceptance of GBL, teacher perceptions of the usefulness of GBL, game-based knowledge, and how frequently they use digital games in their classroom. In the following section, I address the research questions and hypothesis that drove this inquiry.

Research Questions and Hypotheses

To address the purpose of this research study, I investigated the following research questions and hypotheses:

1. What are teachers' experiences with implementing digital games in their classrooms?
2. What factors influence teachers' classroom usage of digital games for learning?

3. What effect does professional development have on factors that influence teachers' usage of GBL?
4. What effect does prior experience teaching with games have on the factors that influence teachers' usage of GBL?

To answer the research questions, I used a path analysis to analyze factors that influence teachers' acceptance (ACC), perceptions of usefulness (PU), perceived barriers (PB), knowledge (KNOW), experiences (EXP), and professional development towards the use of GBL (PD). I also analyzed the correlation between teachers' intention to use (BI) and actual classroom usage of digital games (USE). The following hypotheses guided this study:

$H1_a$: Acceptance of game-based learning will influence the reported use of game-based learning.

$H1_0$: Acceptance of game-based learning will not influence the reported use of game-based learning.

$H2_a$. Educator game knowledge, game pedagogical knowledge, and game pedagogical content knowledge will influence the use of digital games.

$H2_0$: Educator game knowledge, game pedagogical knowledge, and game pedagogical content knowledge will NOT influence the use of digital games.

$H3_a$: Positive perceptions of GBL, including perceived usefulness, ease of use, and benefits for student learning will influence digital game usage.

$H3_0$: Positive perceptions of GBL, including perceived usefulness, ease of use, and benefits for student learning will NOT influence digital game usage.

$H4_a$: Teacher perception of the inflexibility of the curriculum, students' lack of readiness, fixed class schedules, lack of time, and limited infrastructures will influence digital game usage.

$H4_0$: Teacher perception of the inflexibility of the curriculum, students' lack of readiness, fixed class schedules, lack of time, and limited infrastructures will influence digital game usage.

$H5_a$: Professional development to increase teachers' game pedagogical knowledge will influence their perceptions and knowledge of game-based learning and their experience teaching with games.

$H5_0$: Professional development to increase teachers' game pedagogical knowledge will NOT influence their perceptions and knowledge of game-based learning and their experience teaching with games.

$H6_a$. Prior experiences with games, preference for video games, and experiences teaching with video games will influence teacher perceptions and knowledge of game-based learning.

$H6_0$: Prior experiences with games, preference for video games, and experiences teaching with video games will NOT influence teacher perceptions and knowledge of game-based learning.

As data was collected and analyzed, I tested the hypotheses to determine whether the hypothesis is confirmed (i.e., reject the null hypothesis) or denied (i.e., fail to reject the null hypothesis). Conducting tests helped determine if there were significant correlations between the different factors and game usage. Figure 2 below shows the proposed hypotheses of the relationships between the factors and game usage.

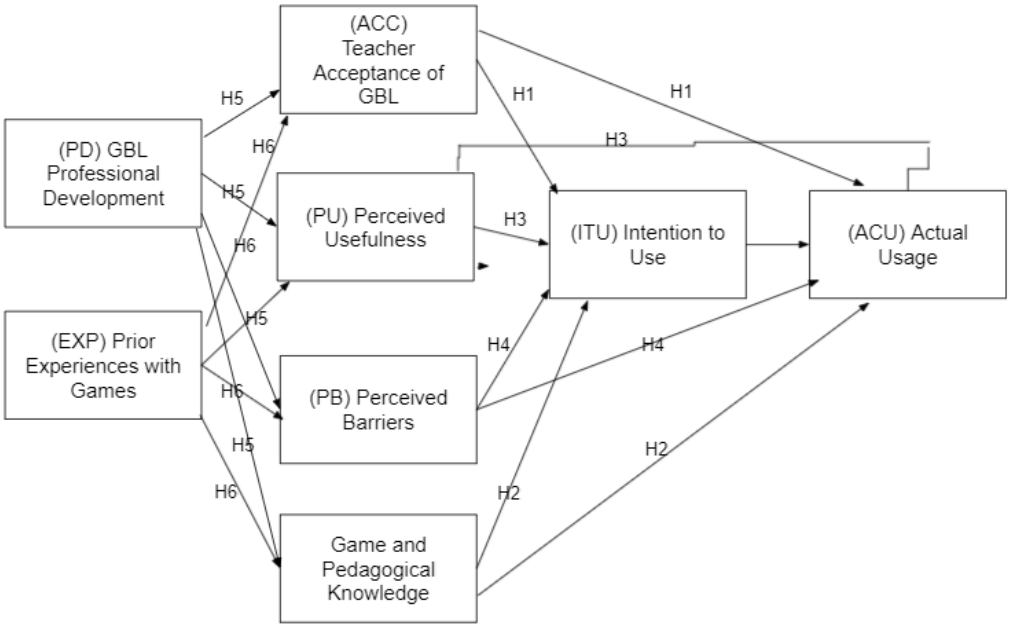


Figure 2 Proposed Path Analysis and Hypothesis

Research Design

This study uses a survey-based concurrent embedded research design. It is a type of design in which qualitative and quantitative data are collected simultaneously, but one type of data is the primary set, and the other type of data provides a supportive, secondary role (Creswell, 2003). This design is based on the work of Campbell and Fiske (1959) who felt that any psychological trait (like decision to use GBL) could best be understood by collecting multiple forms of data. In this study, the quantitative data is the primary type of data being collected in the form of a survey including several 5-point Likert scale questions. Questions asked participants about their experiences, perceptions, knowledge, and usage of game-based learning to help answer the research questions. The same survey also includes qualitative data in the form of open-ended survey question responses to get a more in-depth understanding of teachers' perceptions of GBL and usage of games for learning in the classroom. Figure 3 below shows a visual representation of the research design model for this study. The reason for collecting both qualitative and quantitative data is to get a more complete understanding of the research problem by utilizing the qualitative question responses to explain some of the answers from the survey. The results are integrated in the discussion section with the answers to the research questions.

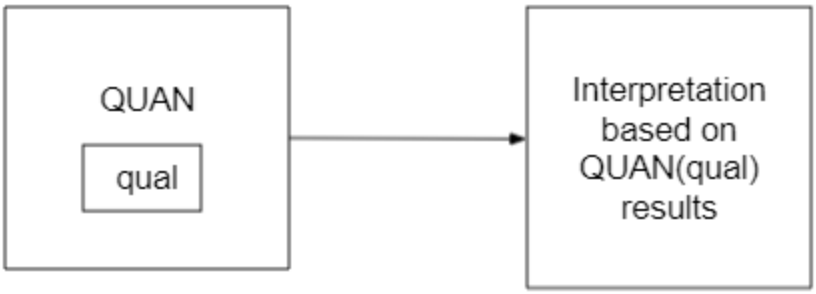


Figure 3 Embedded Research Design Model by Creswell (2003)

Figure 3 showcases the concurrent embedded design research model by Creswell (2003). With this approach, the quantitative and qualitative data are collected within the same sample, with the qualitative data providing a supporting role to the quantitative data.

Participants

The participants in this study were practicing K-12 educators in the United States. The target population of the study was practicing educators because pre-service educators have not yet had to experience working under the constraints of the educational system, and retired educators are not currently working in the educational system regularly. Studying the range of kindergarten through 12th grade educators allows for additional potential participants and the opportunity to learn about the differences in GBL perceptions, attitudes, knowledge, and usage in elementary school educators as compared to secondary school educators. This study sought to have a sample size of between 80 and 160 participants, which was based on the number of parameters being used for the path analysis (Kline, 1998). How games and technology are used and access to digital games

may or may not be drastically different and those differences will become apparent in the survey results.

To collect data, I recruited teachers from my current school district in Virginia and EdTech students at Boise State University. I also did cluster sampling of participants for data collection using an online random generator to select states and school districts. Cluster sampling is a sampling method in which the researcher first identifies clusters and "then randomly selects clusters and studies the individuals within those clusters" (Creswell & Plano Clark, 2018). The clusters in this study were states selected at random, then school districts within those states selected at random, and the prospective participants were the practicing educators within those school districts. The purpose of doing this was to allow for a more random selection of participants to improve the generality of the reported results.

Instrumentation

I collected the data in this study from a survey instrument that was developed based on work by Baek (2008), Hsu et al. (2013), and Waarvik (2019). The open-ended survey questions I developed are based on work by Pinder (2016). The survey was constructed by adapting and combining questionnaires from previous research representing the central ideas in this study. Table 2 below showcases more information about the previous survey instruments and how they influenced the creation of the survey in this study. The survey was pilot tested in May 2021 by a small number of educators to help me determine if the survey functions as intended, check for clarity of items, and see if the results can be analyzed (Sampson, 2004).

Table 2 Description of previous research survey instruments

Author	Description of Instrument	Connection to My Study	Reliability/Validity of Instrument
Baek (2008)	Survey of educator's perceived barriers to using digital games for learning.	Exploring perceived barriers that impact teachers' usage of games. 5-point Likert scale	Each of the items retained from the responses had a loading factor greater than 0.30. The six factors focused on accounted for 41.16% of the variance in usage by participants.
Hsu et al. (2013)	Two surveys with 7-point Likert scale questions	Investigating TPACK-G and Acceptance of Digital Game Based Learning; Path analysis	Overall Cronbach's Alpha scores for the two surveys were .095 and .096
Hsu et al. (2017)	TPACK-G survey with 22 7-point Likert scale questions	Investigating TPACK-G and Acceptance of Digital Game Based Learning; Path Analysis	Overall Cronbach's Alpha scores for the survey was .096
Waarvik (2019)	Online survey utilizing 6-point Likert scale	Similar topic of study and methodology; Likert-scale survey questions; TAM model and TPACK-G	Individual questions were tested for strength of correlation with usage and amount of variance in usage.
Pinder (2016)	10-item Likert type quantitative survey; Three semi-structured interview questions	Similar topic: In my study, I adapted her interview questions and use them as open-ended survey questions.	

All questions on my survey, unless noted otherwise, were questions on a five-point Likert scale ranging from strongly disagree to strongly agree. Using a five-point Likert scale differs from previous studies, which have used a seven-point (Hsu et al., 2013) or six-point Likert scale (Waarvik, 2019). Using a five-point Likert scale reduces the ambiguity in the answer choices in the hopes of reducing frustration level of the

respondents (Babukus & Mangold, 1992), and therefore, increases the number of respondents who participate and the quality of their responses (Sachdev & Verma, 2004). A 'neutral' option was also included for those participants who were truly neutral on the topic, allowing them to give an accurate response (Dillman et al., 2014). My research survey consists of five domains. Appendix E includes a list of the survey questions within each domain.

Quantitative Survey Items

Domain 1: Demographic Survey Items

The survey begins with questions regarding the respondents' demographics. Questions asked about years of teaching experience as well as subjects and grade level taught. These questions may represent mediating variables, and I made correlations between these variables and game usage during data analysis.

Domain 2: Gaming Experience and Teacher Acceptance of Digital Game-Based Learning Survey Items

Five survey questions ask about the teacher's experience with playing games and their overall perceptions about using games in the classroom. Next, four questions adapted from Waarvik's (2019) study focus on the educator's beliefs about the perceived usefulness and benefits of using games in the classroom. These questions were reflective of previous studies that found enthusiastic gamers have shown positive attitudes towards gaming (Bonanno & Kommers, 2008; Hsu et al., 2013), and the adoption of game-based learning in the classroom depends on teacher attitudes and beliefs (Kenny & McDaniel, 2011). Examples of survey items from this section include the following statements: *I am*

enthusiastic about using games in the classroom and *The characteristics of digital games can help instruction*.

Domain 3: Perceived Barriers Survey Items

Eleven questions assess perceived barriers to implementing GBL. These questions are based on Baek's (2008) and Waarvik's (2019) surveys and focus on potential barriers of flexibility of the curriculum, student readiness, time for implementation, access to games and resources, and administrative support. Baek (2008) found that these potential barriers accounted for 41.6% of the variance in GBL usage. Four survey questions were included to measure actual reported weekly usage in the classroom. The questions based on Waarvik's (2019) survey focus on how often educators use games in their classroom, and the various ways they could be using digital games for learning, such as a primary or supplemental instructional tool or as a classroom reward. Examples of survey items in this section include the statements: *The time allotted for the curriculum would allow me to teach using digital games* and *Administration would support my use of digital games for learning*.

Domain 4: Knowledge of Games and Teaching with Games Survey Items

Five questions are included based on Hsu et al. (2017) and Waarvik's (2019) work to measure the teacher's game-based knowledge. Four survey questions measure game knowledge (GK), five questions measure game pedagogical knowledge (GPK), and five questions measure game pedagogical content knowledge (GPCK). This study evaluates the relationship between GPCK and actual usage, which was not the case in Hsu and Chai's (2012) original survey about Technological Pedagogical Content Knowledge – Games (TPACK-G). The survey conducted by Hsu et al. (2017) had

Chronbach's alpha coefficients between 0.94 and 0.97 and an overall reliability coefficient of .95 (Waarvik, 2019). Examples of survey items in this section include statements such as: *I am able to facilitate my students' collaboration with each other using digital games* and *I know how to select appropriate digital games according to my students' learning needs*.

Domain 5: Qualitative Survey Items

The final five questions in the survey are open-ended questions intended to get a more complete picture of the educators' thoughts and perceptions on game-based learning, benefits for student learning, and potential obstacles or barriers. These questions exemplify questions used in Pinder's (2016) study in which she conducted semi-structured interviews as part of the qualitative data collection in the study. I selected these questions to allow participants to confirm their responses to similar questions in the quantitative section and allow for additional context to their responses. Each question highlights a factor that influences teacher GBL usage, which is the focus of this study. The questions included in this survey are:

1. What are your perceptions/views on using games in the classroom to teach content to students?
2. In what ways has game-based learning impacted your traditional teaching of content?
3. Thinking about your students, in what ways have you seen or identified that using game-based learning may have impacted their learning, especially with skill(s) development?

4. What, if anything, do you see as an obstacle to integrating game-based learning in your classroom?
5. Where do you go for additional professional development to increase your knowledge about using games for instruction in your classroom?

Reliability and Validity of Survey Instrument

I used Cronbach's Alpha to determine the reliability of my survey. Cronbach's Alpha is a standard measure of internal consistency to help researchers determine if their scale is reliable (Goforth, 2015). It is mostly used when researchers use multiple Likert scales in a questionnaire (Jamil et al., 2019). The Cronbach's Alpha score was .982, which is considered a reliable instrument. Kaiser-Meyer-Olkin measure of sampling adequacy was .93. KMO values between .8 and 1 are adequate samples (Glen, 2016). Bartlett's test of sphericity was statistically significant with a $p < .05$. The survey instrument was pilot tested by a small group of educators and reviewed by the dissertation committee to elicit feedback and help establish face validity of the instrument.

I conducted item analysis on the survey questions to help determine the validity of the survey instrument. I analyzed descriptive statistics, and the results show that the survey does not have missing values and the valid sample size is 133. The results of this item analysis are available in Appendix G. The total percentage of explained variance is 83.7%. This represents the construct validity of the survey instrument. I ran item-total correlations tests on the survey items related to each factor, comparing them with the total score for that factor (for example, EXP). If the questions were well-designed and did not cause any misunderstanding, they would show high correlation with the total score.

The threshold for keeping a question in this analysis is 0.5 (Lester et al., 2014). The results showed that all questions when compared to the related total score were above 0.5, thus all questions were kept for data analysis. The results of these tests are available in Appendix I.

Procedures and Data Collection

This study uses a survey to gather large-scale data from many educators. I conducted the survey online because it is more convenient, asynchronous, and allows for a broader geographic reach for sampling. Table 3 below shows information aligning the research questions and hypothesis to the data collection and analysis.

Table 3 Alignment of Research Questions and Hypothesis to Data Collection and Analysis

Research Question	Hypothesis	Data Sources
What are teachers' experiences with implementing digital games in their classrooms?	This one does not have a hypothesis – I plan to report what I learn from the responses.	Online survey Five questions in the survey are open-ended qualitative questions intended to get a more complete picture of the educators' thoughts and perceptions on GBL, benefits for student learning, and potential obstacles or barriers.
What factors influence teachers' decision-making about using digital games for learning and lead to increased classroom usage?	H_1. Acceptance of game-based learning will influence the reported use of game-based learning. H_2. Educator game knowledge, game pedagogical knowledge, and game pedagogical content knowledge (TPACK-G) will influence the use of digital games. H_3. Positive perceptions of GBL, including perceived usefulness, ease of use, and benefits for student learning will influence digital game usage. H_4. Teacher perception of the inflexibility of the curriculum, students' lack of readiness, fixed class schedules, lack of time, and limited infrastructures will influence digital game usage.	Online survey Five survey questions ask about the teachers' experience with playing games and their overall perceptions about using games in the classroom. Next, four questions focus on the educators' beliefs about the perceived usefulness and benefits of using games in the classroom. Eleven questions assess perceived barriers to implementing GBL. Five questions are included to measure teacher's knowledge about games and teaching with games. The final five questions in the survey are open-ended qualitative questions intended to get a complete picture of the educators' thoughts and perceptions on GBL, benefits for student learning, and potential obstacles or barriers.
What effect does professional development have on GBL integration have on teacher's perceptions of GBL and their Games Pedagogical Content Knowledge?	H_5. Professional development to increase teacher's TPACK-G will influence their perceptions of game-based learning and classroom usage.	Online survey Four quantitative questions and one qualitative question ask about teachers' prior professional development on GBL.
What effect does prior experience with games and GBL have on teachers' perceptions of GBL and their Games Pedagogical Content Knowledge?	H_6. Prior experiences with games, preference for video games, and experiences teaching with games will influence teacher perceptions of game-based learning and classroom usage.	Online survey Ten survey questions ask about the teacher's experience with playing games and their overall perceptions about using games in the classroom.

I created the online survey instrument using Qualtrics. My goal was to get at least 80 participants. I contacted target population school districts to obtain permission to administer the survey to potential participants. Procedures for obtaining permission vary by school district. Some districts have thorough processes and research forms to complete which are then reviewed by a committee. Other districts may just require an email to the superintendent requesting consent. Once consent was received, a link to the Qualtrics survey was sent via e-mail to K-12 educators within target school districts. Surveys were sent out to current educators with existing email addresses, which are publicly available on school district websites. Reminders with the survey link were sent to all eligible participants bi-monthly until the target number of responses was received and data analysis began.

Data collection continued until the number of respondents surpassed the minimum number of 80 participants, at which point the data analysis began. According to Kline (1998), adequate sample size is ten times the number of parameters in path analysis, and the best sample size should be 20 times the number of parameters. In this study, the path analysis consists of eight different parameters. I sought to have between 80 and 160 participants to have an adequate sample size for analysis.

Data Analysis

Quantitative Data Analysis

I downloaded the data collected from Qualtrics into a format that SPSS 28 can use. The data analysis consisted of an initial screening for participants with many missing responses or responses from participants not in the target population. There were nine responses that had zero questions answered so those were excluded from analysis. There

were 19 responses that were partially complete and data from partial completions was used. I analyzed descriptive data for demographic information and data on the usage of digital games by the participants. I conducted multiple regression analyses on each of the individual factors to test how each of them could predict the dependent variable of usage.

I used SPSS 28 software to analyze the quantitative data from the survey. I developed a path analysis using SPSS Amos 28 software to understand the relationships among the variables (Cheng et al., 2013). Using this analysis, I looked for correlations that impact the path to classroom usage and implementation of GBL. Path analysis allows for a better understanding of the relationships between and among variables examined in a study (Kellar & Kelvin, 2013). Path analysis builds upon simple multiple regressions by examining both direct and indirect effects of various X variables on the Y variable (Allen, 2017). The path analysis in my study explored the correlation and sequence of events between professional development and prior experiences with games and their impact on variables related to teacher perceptions of GBL, leading to actual usage or intention to use in the classroom. Figure 4 below showcases the initial path analysis diagram, which displays the independent variables of "experiences and acceptance of GBL," "perceived usefulness," "educator game and pedagogical knowledge," and "perceived barriers". These independent variables will serve as exogenous variables, which are variables not explained by other variables in a model. The diagram also shows the dependent variables of "intention to use" and actual "GBL usage" in the classroom. These variables will serve as endogenous variables in the model, which are variables that are explained by other variables in the same model (Sarwono, 2017).

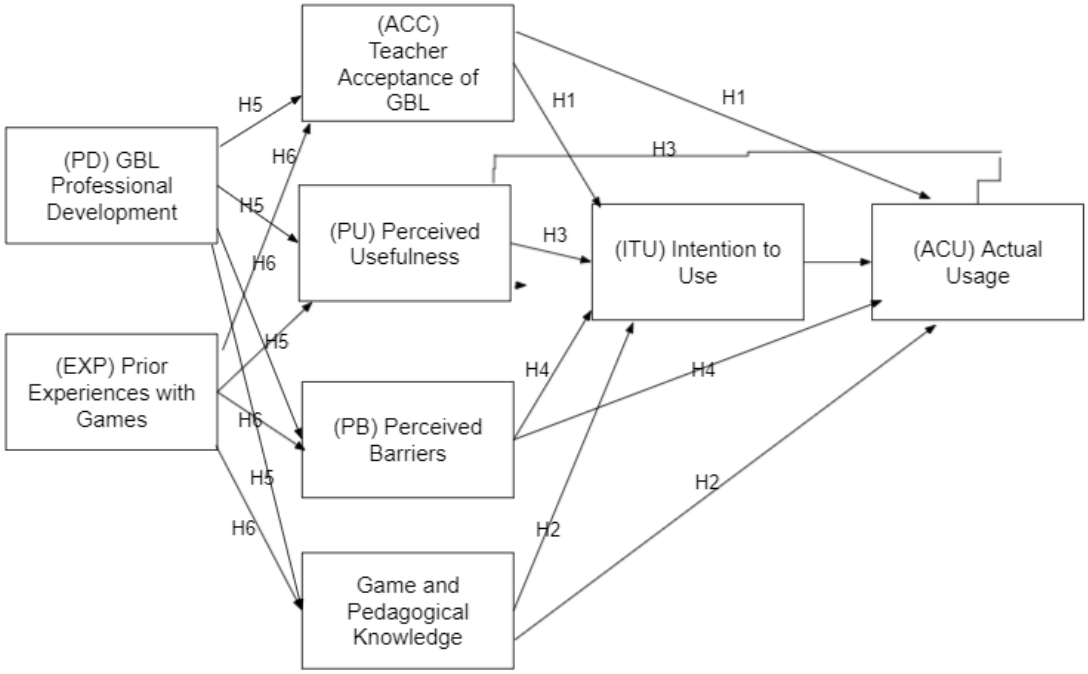


Figure 4 Path Analysis Diagram

Convergent validity is the degree to which measures of constructs that would theoretically relate to one another are related (Taherdoost, 2016). Convergent validity can be tested to see if the constructs in a model are related. In this study, I conducted this test using a principal component analysis (PCA) with a varimax rotation method (Koh & Nam, 2005; Wee & Quazi, 2005). I tested my different factors using PCA to determine their suitability for factor analysis and kept them in my revised path model.

Qualitative Data Analysis

The short answer questions were coded and analyzed using the qualitative data analysis software, NVivo. The first step in this analysis process was to read through the responses. During the first cycle of coding, I used In vivo coding. In vivo codes were used for parts of the responses that stand out from the participant's "voice". The responses were initially analyzed using an open coding method which allowed me to

record instances of recurring words or phrases. Open coding allows a researcher to analyze data without having already prepared categories for the responses (Creswell & Poth, 2018). I read and re-read the responses to familiarize myself with them and identify initial codes based on surface level semantics in the data (Braun & Clarke, 2006). The next step was to do pattern coding where I categorized the codes to create themes. Theming the data is a method of finding commonalities between categories. The process of coding helps researchers make sense of the text and organize it into bits that allow for easy finding and organization later (Miles et al., 2020). I conducted semantic analysis on the responses to the open-ended question 1 asking about teachers' perceptions on using games in the classroom. Semantic analysis is used to analyze subjective like opinions and attitudes in written text (Ignatow & Milhalcea, 2017). I completed a word frequency count to determine words or phrases that are common themes in the qualitative responses. I was looking for frequently used words in the question where participants shared their thoughts about perceived barriers to implementation. I also analyzed the data for length of responses and cross-referenced the responses with the descriptive statistics of grade level taught and years of experience to identify any trends with certain participants and the length of their responses to the questions.

Ethical Considerations

In preparation for any study, researchers need to consider any ethical issues that may arise (Creswell, 2014). Researchers should consider the important ethical areas of access to data, documentation of the data collection process, and the storage and archiving of data after the study is concluded (Miles et al., 2020). The plan for data collection in this study included obtaining necessary permissions from participants before

beginning the study. Participants in the study were consenting adults over the age of 19. Prior to their participation, I provided participants with an information sheet sharing the purpose of the study, what the study is asking of them, and how the data will be used. Participants provided their informed consent prior to beginning the survey and were able to opt out of participating at any time by not submitting the survey (Fleming and Zegwaard, 2018).

Participants in the study included educators from within the school district where I work and Boise State University. While this familiarity allows for a convenient sample and potentially more educators choosing to participate, this does not present an ethical issue because I do not have a vested interest in whether my hypotheses are supported by the results (Creswell, 2014). I am simply seeking to understand the educators' perceptions that do choose to participate, contribute to existing research on the topic, and make recommendations for future professional development on the topic. I do have an interest in seeing digital games being integrated with fidelity. However, when analyzing qualitative data responses, I just focused on the descriptors. The data represented was all inclusive, and I accounted for all comments.

It is vital to store and protect the data collected in a research study. The Qualtrics survey responses, along with any related files, were password protected and stored on my password protected Qualtrics account. I avoided ethical issues during data analysis and reporting by disclosing all results, respecting the participants' privacy, avoiding plagiarism, and communicating in clear, straightforward language.

Limitations and Delimitations

Limitations are potential weaknesses in the design of the study that are out of the researcher's control (Simon, 2011). There are a few possible limitations to the scope of this study. The self-report nature of the data collection does create the possibility that respondents do not answer truthfully, may not fully understand the questions, or may select responses quickly without fully taking the time to read the questions. One other possible limitation of the study with survey-based research is the potential for response bias, which is the impact of nonresponses on the survey responses (Creswell, 2014; Fowler, 2009). It could be that educators more likely to integrate game-based learning into their classroom may also be more likely to complete this survey, which could inflate the data on how often educators are using games in their classrooms. The results chapter of the study will report on the numbers of participants who did complete the survey (Creswell, 2014).

Delimitations are decisions made for the study design that limit the scope and define boundaries, but are within the researcher's control (Simon, 2011). This study focuses on K-12 educators in the United States, and thus the results may not extend internationally. Another delimitation may be that my survey is long which may cause survey fatigue. To mitigate this issue, the survey was paired down to 40 questions and I limited short answer responses and spread them throughout the survey. Another delimitation is the online nature of the survey used for data collection, which may limit respondents to educators who are comfortable and willing to complete an online survey, which may eliminate those educators who are less comfortable using technology. My purpose statement explains the intent of the research which includes the intended

accomplishments and understanding of what the study will and will not cover. The survey seeks to try and mitigate these issues by making the questions simple and easy to comprehend, and by pilot testing the survey with a few teachers to establish face validity.

Chapter 3 Summary

The study described is a survey-based concurrent embedded study intended to measure the perceived benefits and barriers of integrating game-based learning, game-based technological pedagogical content knowledge, and other factors that may influence the usage of digital games in the classroom. Participants in this study were current K-12 educators in the United States and participation occurred via an online Likert-scale survey with additional open-ended questions. The Qualtrics survey asks questions about demographics, teacher experiences with playing and teaching with games, their perceptions about their acceptance of games, usefulness of teaching with them, perceived barriers to implementation, along with their knowledge of teaching with games. During the data analysis stage, I looked for correlations among the factors that influence a teacher's decision to implement GBL in their classroom. Ethical issues have been considered and were avoided during the study. Possible limitations include the focus of educators in the United States, the online nature of the survey, and the potential impact of nonresponses on the survey results.

CHAPTER FOUR: RESULTS

This chapter contains the data collection results and explanations of the statistical outcomes that were used to answer the research questions and test the hypotheses. The data shared in this chapter will be used to draw conclusions from the research. The results in this chapter show some trends in the data that can help explain the perceptions of educators who use game-based learning (GBL) and the factors that influence their decisions to implement the use of games in their classroom.

Descriptive Statistics

This section shares the results from descriptive statistics testing that was done to analyze the responses from the participants. The descriptive statistical testing included analyzing survey items related to demographic information, digital game usage, and professional development.

Demographics

There were 133 participants in this study. Of the 133 participants, 114 (86%) completed the survey, and 19 (14%) participants partially completed the survey. One hundred twenty-five of the participants were from a school district in Virginia, and eight participants were graduate students from Boise State University. There was a variety of years of teaching experience, 15 teachers had zero to three years of experience, 18 teachers had four to six years of experience, 12 teachers had seven to nine years of experience, 27 teachers had ten to thirteen years of experience, and 60 teachers had fourteen or more years of experience. Figure 5 further details this information.

Comparing this group of participants to previous national studies, Fishman et al. (2014) had participants with an average of 14 years of experience and nearly half of their participants were middle school teachers while Takeuchi and Vaala (2014) had 46% of their participants were K-5 teachers and a much smaller percentage of middle school teachers (11%).

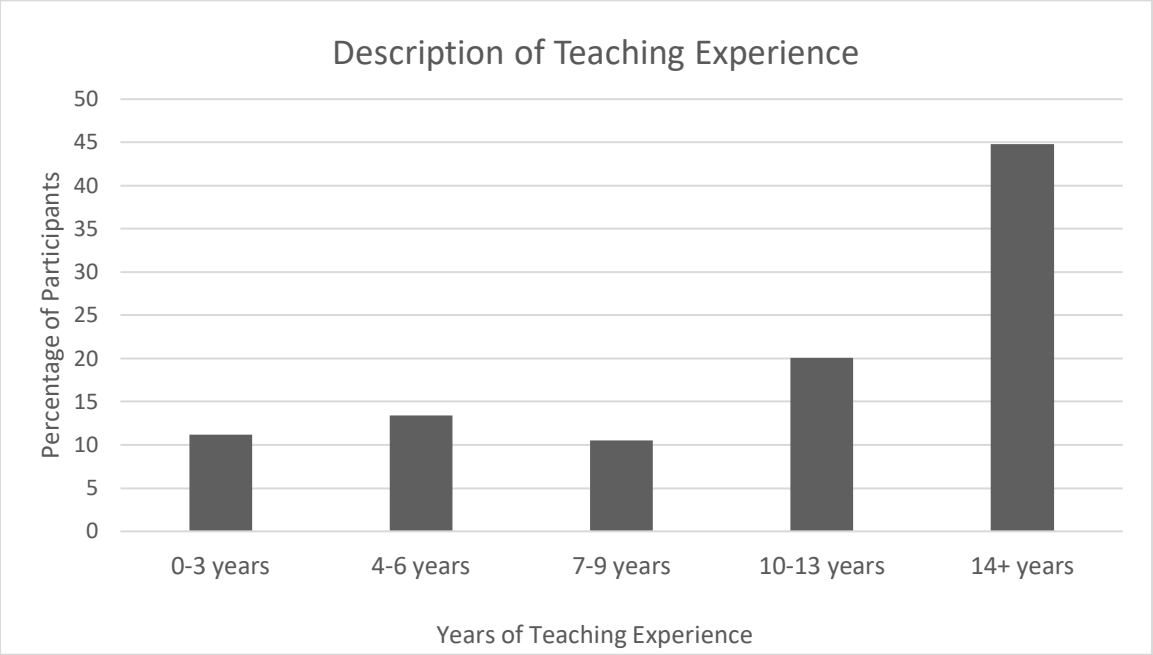


Figure 5 Description of Teaching Experience

In Figure 6, I provide more information about the primary grade level taught by the participants. Notice that elementary school educators represented the majority of the participants (71.4%).

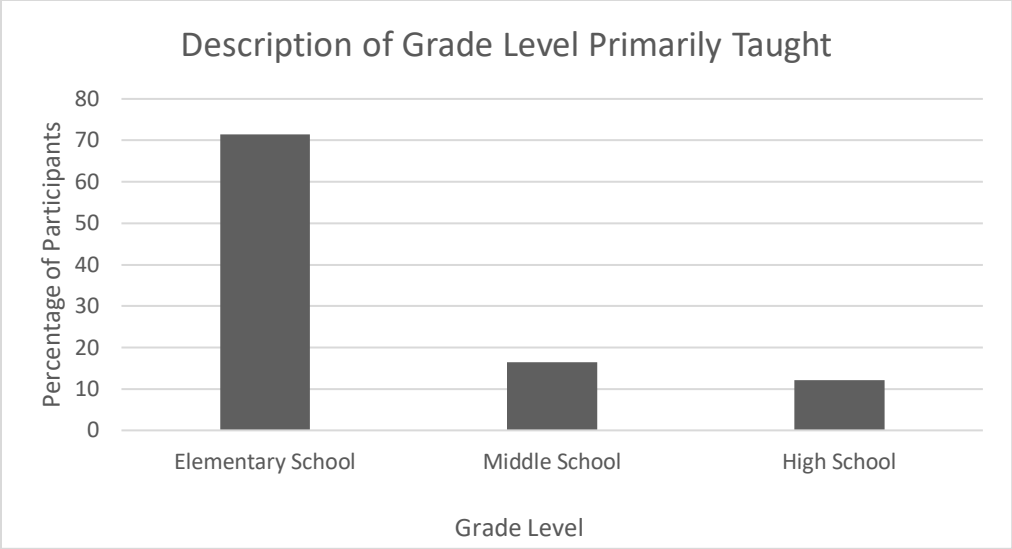


Figure 6 Description of Grade Level Primarily Taught

Figure 7 highlights the different subjects the participants teach. Notice that the largest group of educators teach all subjects (42.9%), which makes sense since the largest group of responses came from elementary school teachers, many of whom teach all subjects.

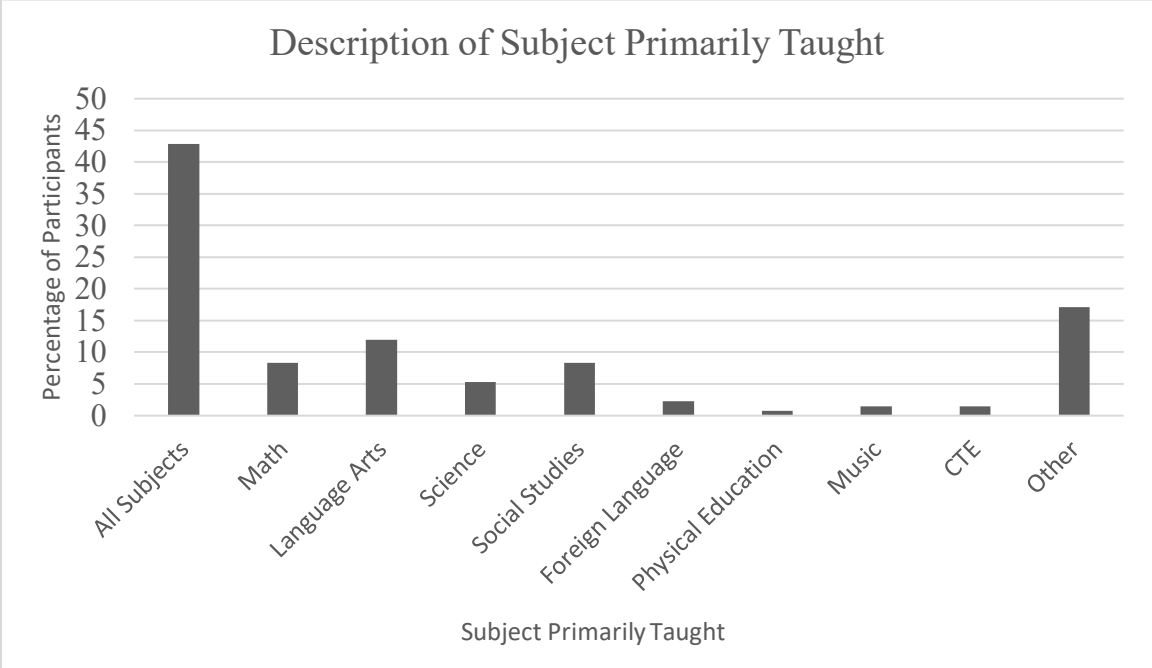


Figure 7 Description of Subject Primarily Taught

Game Usage

Out of 114 educator responses about GBL usage, 99 (86.8%) teachers reported they use games on average at least once per week, and 15 (13.2%) reported not using games in their classroom. Nineteen participants did not answer these questions. See Figure 8 for the dichotomous usage of digital games by teachers. Non-responses in the table are represented by the number '99'. This data helps to showcase reported usage of GBL in classrooms, which is a focus area of this study, and the different instructional purposes in which educators report using games.

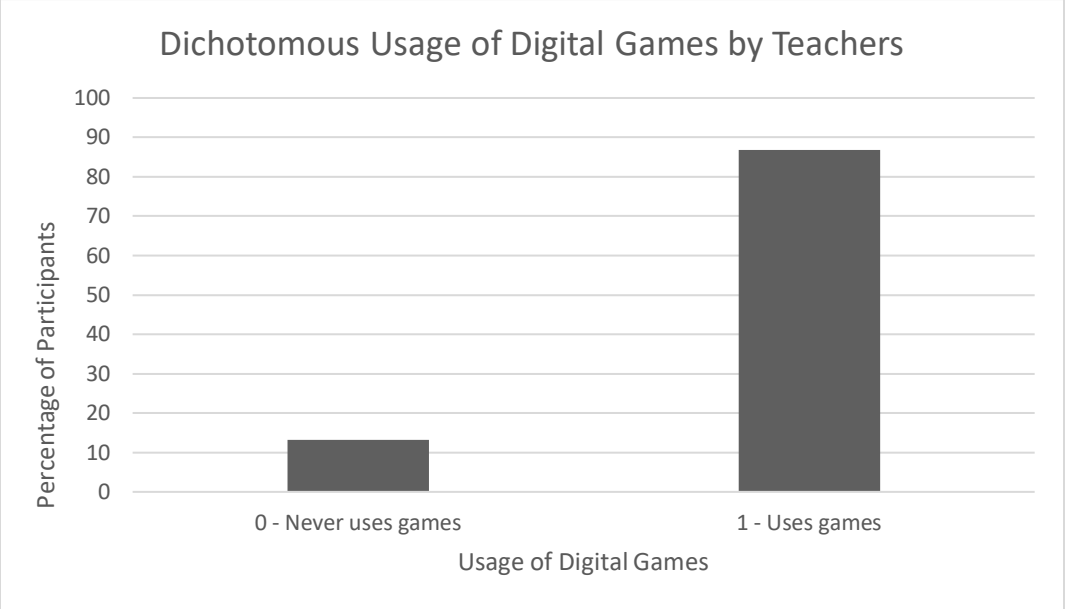
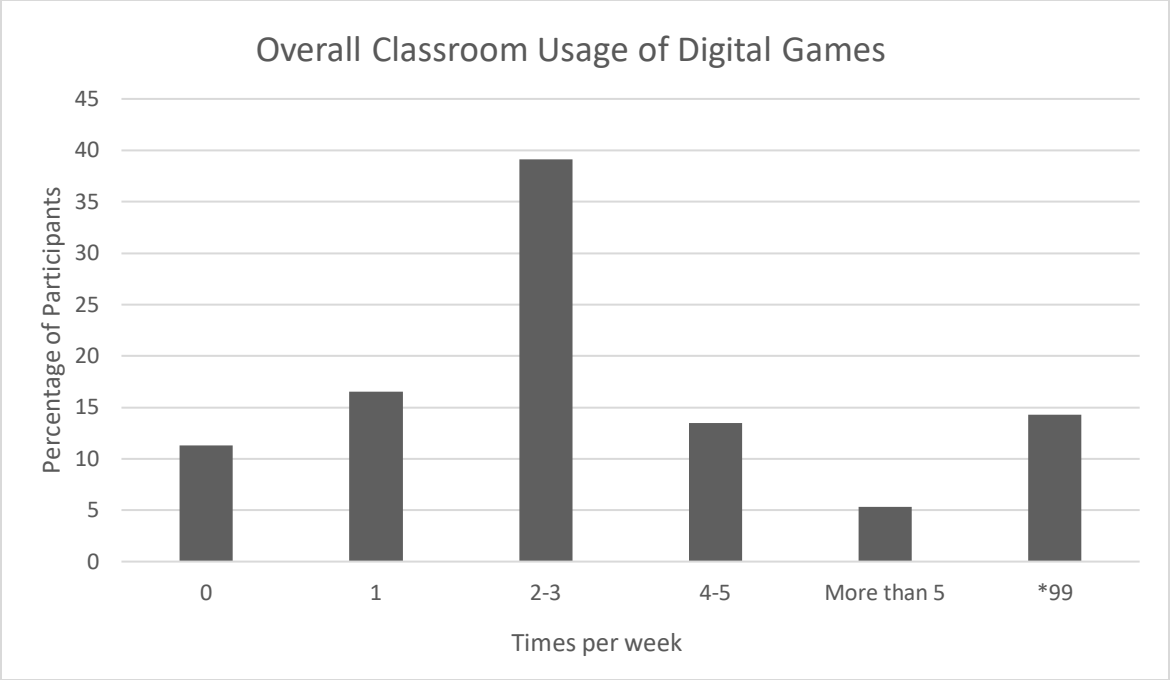


Figure 8 Dichotomous Usage of Digital Games by Teachers

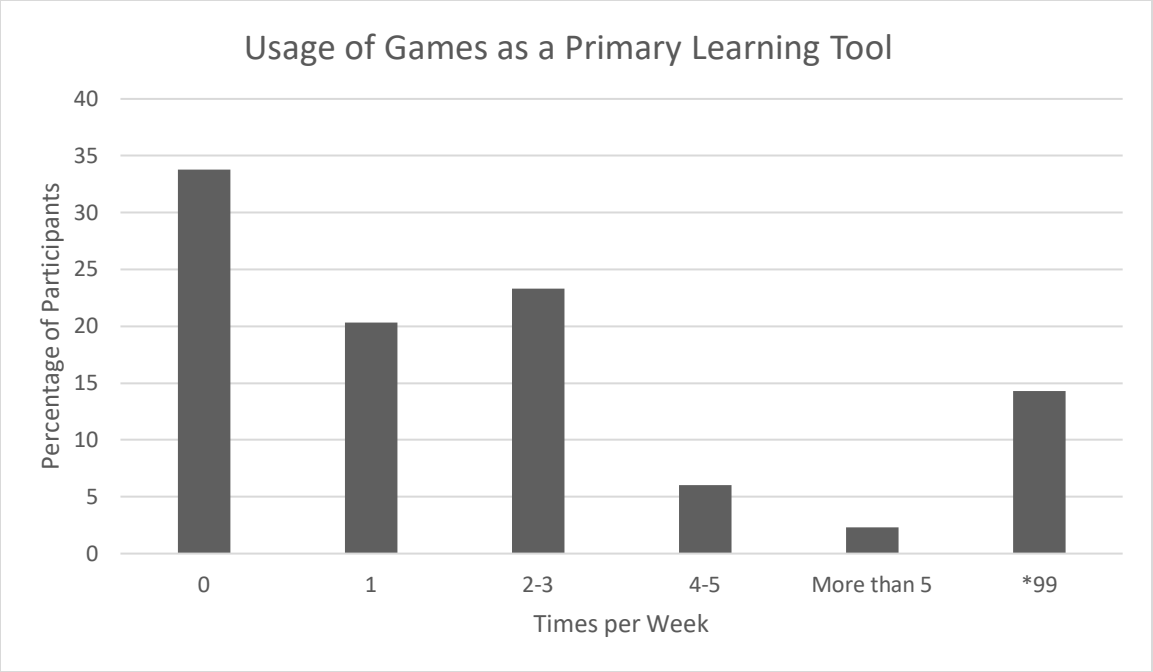
Twenty-two teachers (16.5%) reported using games only once per week, while 25 (18.8%) reported using games four or more times per week. Figure 9 highlights this information of how many times per week teachers are using digital games in their classroom.



*Incomplete responses were coded with the number 99.

Figure 9 Overall Classroom Usage of Digital Games (Times per week)

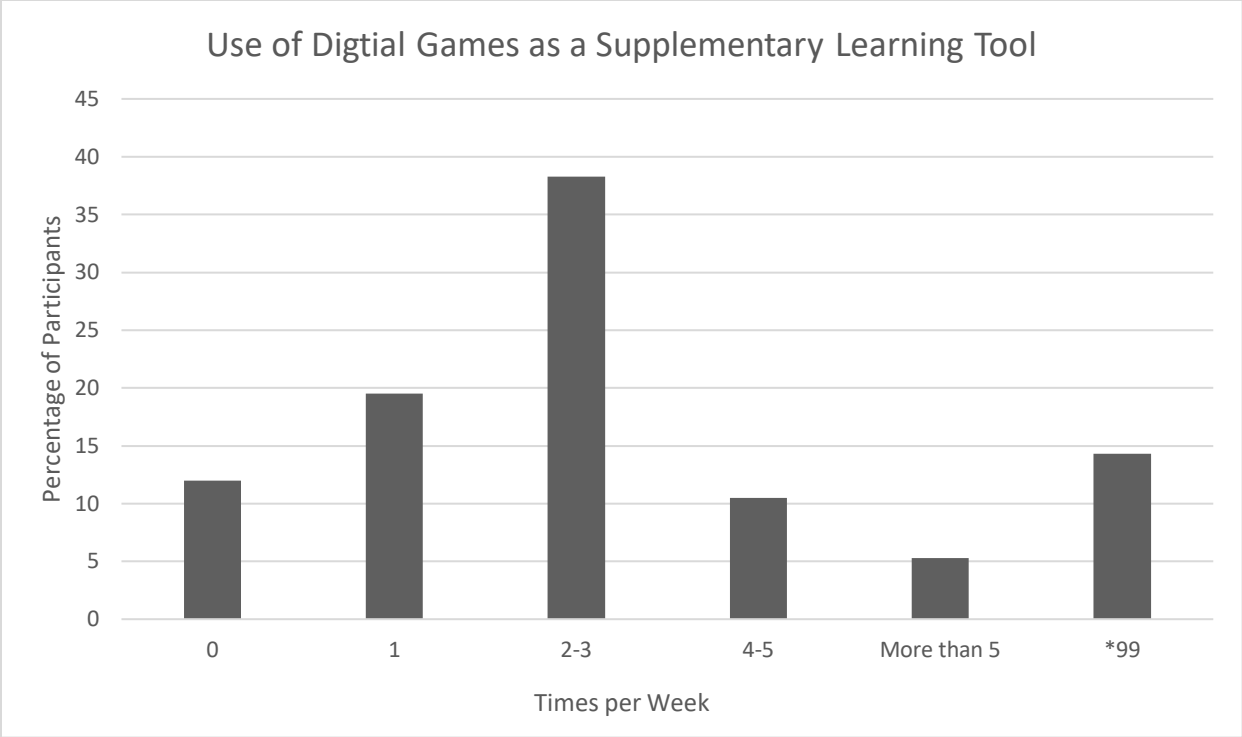
Of the teachers that use games in their classroom, 69 (51.9%) reported their students use games at least once per week as a primary means of learning content. Figure 10 showcases this information below.



*Incomplete responses were coded with the number 99.

Figure 10 Usage of Games as a Primary Learning Tool (Times per week)

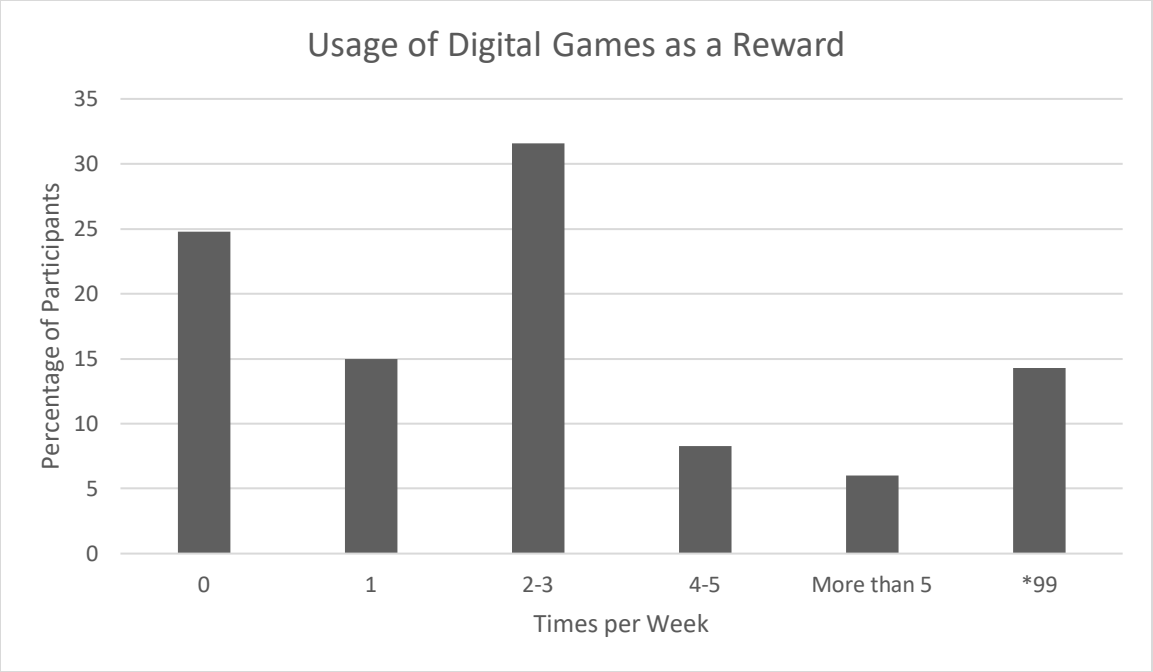
Meanwhile, Figure 11 below shows that 98 (73.6%) of educators reported their students use games at least once per week as a supplemental means of learning content.



*Incomplete responses were coded with the number 99.

Figure 11 Use of Digital Games as a Supplementary Learning Tool (Times per week)

Eighty-one teachers (60.9%) reported using games at least once per week for rewards. Figure 12 shows how often teachers are utilizing digital games as a reward.



*Incomplete responses were coded with the number 99.

Figure 12 Usage of Digital Games as a Reward (Times per week)

Survey results suggest that many educators (86.8%) are using games in their classroom, with 18.8% of educators using them daily. Fifty-two percent of educators use games in their classroom as a primary learning tool for students at least once per week, while 73.6% of educators use games as a supplemental learning tool at least once per week. Overall, it appears that most teachers are utilizing digital games in their classroom as an instructional tool to teach content.

Professional Development

Participants reported where they seek professional development (PD) to learn about GBL. Table 4 showcases these results. Thirty-eight teachers (28.6%) reported that they seek out other teachers when trying to learn about integrating games, which was the highest response. Only two educators (1.5%) reported seeking out online communities for gamers as a source for PD, which was the least amount. Other responses for where

teachers seek PD on digital games included video tutorials (13.5%), social media (15.0%), in-service district PD (20.3%), online communities for educators (15.8%), and their instructional technology coach (18.8%). Twenty-three educators (17.3%) reported that they do not seek out PD on integrating games into their classroom.

Table 4 Where Do Educators Go to Seek PD on Integration of Digital Games

PD Source	*Other Teachers*	*Online Educator Communities*	*Online Gamer Communities*	*Social Media*	*In-Service PD*	*Tech Coach*	*Video Tutorials*	*Do Not Seek PD*
Frequency of Responses	38	21	2	20	27	25	18	23
Percent	28.6%	15.8%	1.5%	15.0%	20.3%	18.8%	13.5%	17.3%

Path Analysis for Research Model

Correlations Between Individual Questions and Factors

I tested individual survey items for strength of correlation with usage and to explain the amount of variance in usage. The two questions with the highest correlation with usage were, “I am knowledgeable about managing digital games in my classroom” (.634) and “I understand how to implement digital games in my classroom” (.643), which are both measures of knowledge about games and teaching with games (KNOWL) and ease of use (EOU). These two questions made up 42.4% of the variance in usage. The questions presented in Table 5 all had a correlation of over .50 with usage. The survey items can be found in Appendix E.

Table 5 Strength of Individual Survey Question Correlations to Game Usage

	Q11	*Q16*	*Q17*	*Q18*	*Q20*	*Q21*	*Q28*	*Q38*
Pearson Correlation	.509	.561	.591	.565	.515	.567	.533	.529
	Q39	Q40	Q41	Q42	Q43	Q44	Q46	
Pearson Correlation	.634	.643	.604	.570	.571	.614	.543	

Sig. (2-tailed) <.001; N = 133

I ran correlations between the different factors and GBL usage. The testing showed all the variables were statistically significant as the *p* values were less than .05. The strongest correlations to usage were ease of use (EOU), knowledge of games and teaching with games (KNOW), perceived usefulness (PU), and perceived barriers (PB). The lowest correlation was experience (EXP). Table 6 below shows the correlations between the different factors and game usage.

Table 6 Correlation of the Different Factors to GBL Usage

		EXP	ACC	PU	PB	BI	EOU	KNOW	PD
USE	Pearson Correlation	.376	.452	.595	.585	.744	.626	.612	.543

Sig. (2-tailed) <.001; N = 133

Perceived Barriers

Each survey item categorized as a perceived barrier to implementation of GBL was correlated with usage. Six of the survey items were found to have Pearson Correlation of above .50, which shows a positive and strong relationship with usage. These items included administrative support, ability of teachers to find games for learning objectives, having

access to hardware to run the games, and student skill level/classroom management. The other four items, which focused on time and technologies being powerful enough to run the games, showed to have a moderate correlation with usage. Exploratory Factor Analysis was conducted, and all 10 items were loaded into a single construct. These items were combined into a single factor known as perceived barriers (PB). Table 7 below showcases this information.

Table 7 Correlations Between Perceived Barriers Survey Items and GBL Usage

	PB1	PB2	PB3	PB4	PB5	PB6	PB7	PB8	PB9	PB10
Pearson Correlation	.515	.567	.543	.606	.462	.371	.423	.461	.585	.533

Sig. (2-tailed) <.001; N = 133

Factors impacting usage of GBL

Using principle components analysis with varimax rotation, I conducted exploratory factor analysis on 29 survey items. The analysis yielded three factors explaining a total of 71.95% of the variance in the data. Table 8 below shows the explanation of total variance results from this analysis. Factor 1 was labeled "teacher perceptions" and includes the high loading items from the categories *perceived usefulness* and *perceived barriers to implementation*. Factor 1 explained 52.34% of the variance after rotation. Factor 2 was labeled "knowledge" which combines the high loadings from the categories of *knowledge, professional development, and ease of use*. The second factor explained 10.52% of the variance after rotation. The third factor was labeled "experiences with games" combining items from the categories of experience and acceptance of GBL. Factor 3 explained 9.10% of the variance after rotation. The rotated component matrix chart is a chart showing the breakdown of the survey items into these three factors. These three factors were analyzed using a path analysis to identify correlations with classroom usage. This chart is available in Appendix H.

Table 8 PCA Total Variance Explained Chart

	Initial Eigenvalues		Extraction Sums		Rotation Sums	
Component	Total	% of Variance	Total	% of Variance	Total	% of Variance
1	18.583	64.078	18.583	64.078	9.885	34.087
2	3.578	12.339	3.578	12.339	7.790	26.864
3	2.118	7.304	2.118	7.304	6.603	22.770
4	.731	2.521				
5	.685	2.361				
6	.411	1.416				
7	.328	1.131				
8	.314	1.083				
9	.278	.957				
10	.254	.875				
11	.220	.758				
12	.184	.633				
13	.178	.615				
14	.146	.503				
15	.132	.457				
16	.121	.416				
17	.115	.395				
18	.107	.368				
19	.090	.309				

20	.072	.248
21	.068	.236
22	.059	.202
23	.052	.179
24	.043	.147
25	.037	.129
26	.032	.112
27	.026	.090
28	.023	.078
29	.018	.062

Extraction Method: Principal Component Analysis

The Path model shown in Figure 5 includes three independent variables (teacher perceptions, knowledge, and experiences with games) that served as exogenous variables and two dependent variables (behavioral intention to use and game usage) that served as endogenous variables. Table 9 shows the Pearson Correlations between the variables.

Table 9 Pearson Correlations Between Variables

		BI	TP	KNOWL	EXPG
Pearson Correlation	BI	1.000	.804	.725	.503
	TP	.804	1.000	.632	.548
	KNOWL	.725	.632	1.000	.466
	EXPG	.503	.588	.466	1.000

Sig. (1-tailed) <.001 for BI, .000 for others; N = 133

The correlation coefficient between teacher perceptions and knowledge is 0.632, indicating a strong and positive relationship. The correlation coefficient between teacher perceptions and experiences with games is 0.548, which means the relationship between these two variables is also strong and positive. The correlation coefficient between knowledge and experiences with games is 0.466, indicating that the relationship between these two variables is moderate and positive. The significance level of all three comparisons (i.e., teacher perceptions and knowledge; teacher perceptions and experiences; knowledge and experiences) is 0.00, which means the correlation between each of those pairs of variables is statistically significant. Table 10 shows the statistical summary for the developed path analysis model.

Table 10 Path Model Summary

Model	*R*	*R Square*	*Adjusted R Square*	*Std. Error of Estimate*
1	.852*	.725	.719	.857

*Predictors: (Constant), EXPG, KNOWL, TP

As showcased in Table 10, the R square value for the path analysis model is .725 (72.5%), which means the variation of intention to use GBL can be explained by the variables TP, KNOWL, and EXPG. The variation explained by other variables is equal to 27.5%.

In order to test the relationship between usage (dependent variable) and TP, KNOWL, EXPG, and BI (independent variables), I ran another set of linear regression tests. The R square for that model is .579. Tables 11 and 12 showcase the data results from the linear regression tests. Figure 13 and Tables 13 through 16 showcase the path

analysis results for the revised model. Figure 13 was generated with multiple regression analysis.

Table 11 Linear Regression Model Summary

Model	*R*	*R Square*	*Adjusted R Square*	*Std. Error of Estimate*
1	.761*	.579	.566	.915

*Predictors: (Constant), BI, EXPG, KNOWL, TP

Table 12 Linear Regression Model ANOVA*

Model		*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
1	Regression	147.240	4	36.810	43.960	<.001**
	Residual	107.181	128	.837		
	Total	254.421	132			

*Dependent Variable: Usage
**Predictors: (Constant), BI, EXPG, KNOWL, TP

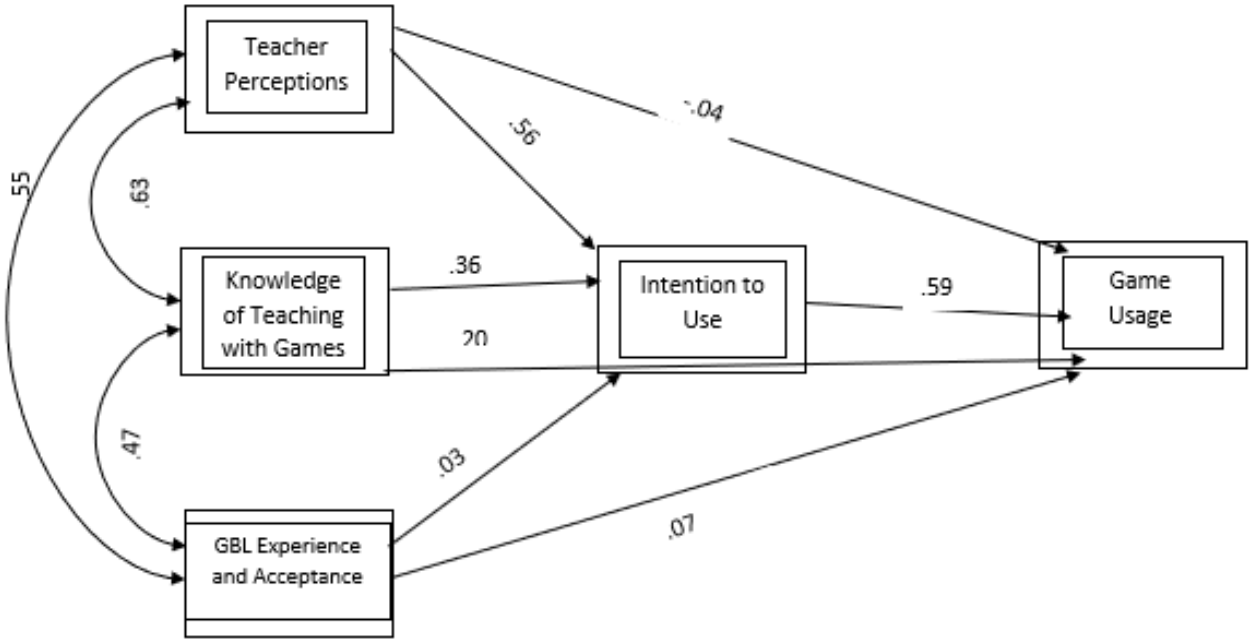


Figure 13 Revised Path Analysis

The path analysis model shows that teacher perceptions had the strongest correlation to intention to use games (BI) at .56, followed by knowledge at .36. Knowledge had the strongest correlation with usage at .204. Out of the three factors, experience had the weakest correlation of the three factors with usage with a .073. Looking at correlations of the three factors to each other, PD had the strongest correlation with knowledge of games and teaching with games at .802. The correlation between PD and teacher perceptions was .471 and between PD and experience teaching with games was .385. The correlation between prior experience and TP was .425, and between prior experience and KNOWL was .396, both of which are moderate and positive correlations. Tables 13-16 detail the results of the testing of the revised path analysis model.

Table 13 Standardized Regression Weights - Default Model

			Estimate
BI	←---	TP	.563
BI	←---	KNOWL	.357
BI	←---	EXPG	.028
USE	←---	BI	.588
USE	←---	TP	-.037
USE	←---	EXPG	.073
USE	←---	KNOWL	.204

Table 14 Chi-square value

Model	*NPAR*	*CMIN*	*DF*		*PCMIN/DF*
Default Model	20	.000	0		
Saturated Model	20	.000	0		
Independence Model	10	403.607	10	.000	40.361

Table 15 Baseline Comparisons

Model	*NFI Delta 1*	*RFI rho1*	*IFI Delta 2*	*TLI rho2*	*CFI*
Default Model	1.000		1.000		1.000
Saturated Model	1.000		1.000		1.000
Independence Model	.000	.000	.000	.000	.000

Table 16 Root Mean Square Error of Approximation (RMSEA)

Model	*RMSEA*	*LO90*	*HI90*	*PCLOSE*
Independence Model	.546	.501	.592	.000

The model fit tests show that there is no significant difference between my revised path analysis model and the saturated or perfect model, which shows that my path model is a good fit. The *behavioral intention to use* (BI) variable serves as a mediating role to the dependent variable *usage*. The direct effect of *intent to use* on *usage* is 0.58. This is slightly above the range Venkatesh and Davis (2000) found in their studies on the correlation between *intent to use* and *actual usage* which was .44 and .57.

The direct influence of *teacher perceptions* on *intent to use* is .56 and influence on *game usage* is -.037. This variable does include questions about perceived barriers, so higher perceived barriers can lead to lower usage. The direct influence of knowledge of teaching with games on intent to use is .36 and the influence of knowledge on usage is .20. The direct influence of experiences with games and acceptance of GBL is .03 on intent to use and .07 on usage. According to the model, these were the variables with the smallest correlations.

Correlations between teacher perceptions and knowledge was .63. The correlation between knowledge and experience/acceptance was .47. The correlation between teacher perceptions and experience/acceptance was .55. These variables have moderate to strong correlations to each other.

Qualitative Data Responses

Qualitative data was collected in the form of open-ended survey questions. Pattern coding was done to identify themes in the data. Word frequency counts were conducted to identify common words or phrases in the qualitative responses.

Participants were asked to share their perceptions on using games in the classroom for teaching content. There were 108 responses to this question with an average word count of 18.469, with a standard deviation of 19.596. Among the responses, the highest word count was 115 words. Table 17 below showcases this information about the length of the responses to this question. Twenty-six participants did not respond to this question.

Table 17 Data from Open Ended Question #1

Open ended Question	Number of Responses	Highest Response Word Count	Average Word Count	Standard Deviation
What are your perceptions/views on using games in the classroom to teach content to students?	107 total 70 ES 21 MS 14 HS	115	18.469	19.596

I conducted semantic analysis on the responses to the open-ended question 1 asking about teachers' perceptions on using games in the classroom. Semantic analysis is used to analyze subjective like opinions and attitudes in written text (Ignatow & Milhalcea, 2017). In this context, I was exploring the responses to identify positive perceptions, which in this context I defined positive as a comment from a participant appearing to show they believe there are benefits and value to using games in the classroom. Eighty-eight responses were coded as being positive comments, which shows that teacher perceptions of using games are generally positive. Even educators who noted that they do not use games in their classroom can see the potential benefits for students. For example, one teacher stated, "I'm not familiar with using digital games in the classroom, but I imagine they would be a good source since that is a platform where many students spend most of their time." Another teacher, who identified they were not a gamer themselves stated, "I understand many of my students are. Encouraging learning through student interest and engagement is important." Some themes that emerged from these responses included motivation and engagement as benefits, games being a good

tool for reinforcing or reviewing concepts, and emphasis on the games being meaningful and appropriate for the content being taught.

Educators were asked to share what they saw as potential obstacles to integration of digital games in their classroom. The most frequently mentioned obstacle, mentioned 54 times, was time, whether it be time during a class period, pacing of the curriculum, or time to find or learn how to develop their own or use existing games for implementation. This was an interesting contrast to the quantitative data, which showed time having a weak correlation with usage. The educators with the most experience also listed time in their response the most, with 20 mentions. The other experience levels had an average of 6 mentions of time. Time was listed the most by elementary school teachers, with 36 mentions. There were six middle school teachers and four high school teachers that mentioned time. Other barriers included difficulty in finding games appropriate for their learning situation, the teacher's own knowledge or comfort level, and challenges with the technology or school networks. Table 18 below shows information regarding the length of responses to this question.

Table 18 Data from Open Ended Question #2

Open ended Question	Number of Responses	Highest Response Word Count	Average Word Count	Standard Deviation
What, if anything, do you see as an obstacle to integrating digital games for learning in your classroom?	101 total 67 ES 20 MS 14 HS	78	10.977	14.552

Forty-three educators indicated they believed GBL has had a positive impact on their teaching of content. Increased engagement was a theme frequently mentioned in the responses. Examples of positive impacts mentioned include educators switching to digital review games instead of using physical materials like flash cards, providing a different platform for students to learn from, and helping to reinforce content. Eight teachers indicated that GBL has had minimal or no impact on their teaching of content. Table 19 below shows information regarding the length of responses to this question.

Table 19 Data from Open Ended Question #3

Open ended Question	Number of Responses	Highest Response Word Count	Average Word Count	Standard Deviation
In what ways has game-based learning impacted your traditional teaching of content?	82 total 53 ES 18 MS 10 HS	131	11.667	17.332

In addition, teachers were asked about the impact of using games on students' learning and skill development. There were 53 responses that identified positive impacts on students' learning. Examples of positive impacts noted included: (1) increased student interest, motivation, and engagement, (2) language development and reading comprehension, (3) critical thinking and problem-solving skills, and (4) communication and teamwork skills. One teacher described her use of digital games as a way to integrate research and how this integration has "allowed my students to learn how to dig deeper into content than the curriculum dictates." Table 20 below shows information regarding the length of responses to this question.

Table 20 Data from Open Ended Question #4

Open ended Question	Number of Responses	Highest Response Word Count	Average Word Count	Standard Deviation
Thinking about your students, in what ways have you seen or identified that using digital games for learning may have impacted their learning, especially with skill(s) development?	76 total 47 ES 17 MS 10 HS	31	8.811	12.110

Lastly, teachers were asked if they would be interested in receiving professional development (PD) to become more comfortable integrating digital games into their classrooms. Overall, most of the educators indicated a willingness or desire to receive additional professional development on GBL. There were several teachers who noted being open to any PD that would be offered, some who mentioned wishing to receive PD through their school district, and others who desired more of a basic overview or a list of specific games that were approved to use and used for certain content areas. There were 10 educators who indicated no desire to receive PD on GBL. Table 21 below shows information regarding the length of responses to this question.

Table 21 Data from Open Ended Question #5

Open ended Question	Number of Responses	Highest Response Word Count	Average Word Count	Standard Deviation
What professional development would you like to receive to help you become more comfortable integrating digital games into your classroom?	72 total 44 ES 16 MS 11 HS	33	8.023	13.169

Chapter Four Summary

In this chapter, I reported the results of a survey on GBL usage. I analyzed and manipulated the data in different ways to answer the research questions and test the hypotheses. Descriptive data was shared on teachers' demographic variables and game usage data. I also analyzed correlations between the survey constructs and usage to determine which factors had positive correlations with game usage. An exploratory factor analysis resulted in three different factors that accounted for 71.95% of the variance in GBL usage. The qualitative survey question responses also supported and explained the factors that influence digital game usage in the classroom, which were labeled teacher perceptions, knowledge of games and teaching with games, and experiences teaching with games. Path analysis with these three factors shows that all three factors correlate with each other, and teacher perceptions had the strongest correlation with intention to use GBL, followed by knowledge.

CHAPTER FIVE: DISCUSSION AND CONCLUSION

In this final chapter, I discuss the results of the hypothesis testing. More specifically, I use the data analyzed in Chapter Four to answer the research questions. Finally, suggestions for future research are explored.

Research Questions Answered

RQ1: What are teachers' experiences with implementing digital games in their classrooms?

The data from the study showed the teachers' experiences (or lack thereof) with integration of digital games in their classroom instruction. Overall, teachers are integrating digital games into their instruction. The survey results showed that 86.8% of educators use digital games an average of at least once per week. This number is consistent with Waarvik's (2019) study, where 86% of educators reported using digital games at least once per week. This number of educators using games is a large increase over the 55% usage rates reported in previous studies by Takeuchi and Vaala (2014) and Fishman et al. (2014). The increase of teachers using digital games in their classrooms may be a result of most participants being in a region (northern Virginia) that has for many years focused on technology integration and innovation and providing support, resources, and expectations for improving technology integration over time. Educators and school districts in Virginia are supported by an advocacy organization (VSTE) that is focused on promoting and supporting the integration of emerging and existing technologies. Virginia was also the first state to require and develop learning standards

for computer science instruction K-12 (Sawchuck, 2017). Within this current study, about 68% of educators reported using digital games in their classroom relatively frequently (i.e., at least two times per week). This is an increase over the 54% of educators who were using digital games at least twice per week in Waarvik's (2019) study. Therefore, findings from this dissertation suggest that more educators are accepting of GBL as an instructional practice and digital games are becoming a more prevalent tool in the educator's toolbox.

The data on game usage shows that digital games are used in different ways. The most common type of usage was for supplementary teaching of content, with 86% of educators using digital games in this way at least once per week. Seventy-one percent of educators reported that they are using digital games as a reward for students, and 69% of educators stated that they are using games as a primary method of teaching content. The results suggest that a majority of educators are teaching with digital games relatively frequently; most of them are using them to supplement and reinforce teaching of content, while using games to primarily teach content was the lowest usage type.

Teacher perceptions of GBL are generally positive. Teacher responses to survey questions about perceived usefulness of digital games ranged from 85.4% and 93.4% with responses of 'Agree' and 'Strongly Agree'. Even teachers that did not have high usage of GBL in their classroom noted that they can see the benefits and how games can be fun or engaging for students. However, there was less agreement related to perceived ease of use. Many teachers agreed with statements related to their ability to design and teach lessons incorporating digital games or selecting games that enhance what they teach ('Agree' and 'Strongly Agree' responses ranging from 55.6% and 64.8%). There was less

confidence in the responses to questions regarding solving technical problems or managing the digital game classroom environment (ranging from 43.5% and 47.2%). This suggests that educators believe making the decision to implement GBL leads to positive benefits for learning and are confident in their ability to design lessons and use games that connect to their curriculum.

Regarding perceived barriers to implementation of GBL, time was identified as the most significant barrier to implementation, with 53 mentions in the short answer responses. The available time during the day, time to learn and find games, finding games to fit the teaching situation, and managing the learning environment (keeping students on task) were obstacles specifically mentioned in the responses. These perceived barriers reported align with the findings of Mokhsin et al. (2016), who identified time for implementation, lack of knowledge for teaching with DGBL, and short class periods as the top barriers to GBL implementation. An interesting comment by one teacher was, "teachers 'believe' there is not enough time to change their current way of teaching." While time is undoubtedly a limitation during the school day, not all teachers agree that it is a limitation preventing the use of digital games in the classroom. Forty-seven percent of educators believe there is enough time for students to learn how to use a digital game in the classroom, 39.5% of educators believe the time allotted in the curriculum allows them to teach using games, and 50.9% of educators feel there is enough time during a given class period to play digital games. Many teachers agree that they have access to digital devices that can play games (84%), their students are skilled enough to learn from games they play in the classroom (78.2%), and administration would support their use of digital games for learning (67.2%). Cost of games, administrative support, and

availability of technology were not identified as major barriers to implementation in this study, which is a shift compared to prior studies about barriers to GBL (Baek, 2008; Watson & Yang, 2016;).

Overall, teachers have positive perceptions about GBL and the use of digital games in the classroom. They recognize the benefits of teaching with digital games including student motivation, engagement, connecting learning with their interests, and for reinforcing concepts. Digital game usage in the classroom has increased over time, with many teachers reporting using games at least once per week. There are barriers and obstacles to implementation, time being the most reported one, but others exist including management of the GBL classroom environment and teacher knowledge. The data suggests that additional professional learning to increase teacher knowledge may help overcome some of these barriers to increase usage. The increased number of educators using digital games may indicate that GBL and digital game usage is becoming more regular, which can also lead to the decrease of certain barriers to implementation that may have existed in the past. The lessening of these barriers and increasing educators' knowledge of teaching with games can help educators feel more confident and therefore lead to increased usage of games in the classroom.

RQ2: What factors influence teachers' classroom usage of digital games for learning?

The findings of the exploratory factor analysis yielded three factors that accounted for a total variance in game usage of 71.95%. The three factors that influence teachers' classroom usage of digital games include: (1) teacher perceptions (TP), (2) knowledge of games and teaching with games (KNOWL), and (3) experiences with games (EXPG). Teacher perceptions had the strongest correlation to intention to use

games (BI) at .537, followed by knowledge at .438. Knowledge had the strongest correlation with usage at .204. Out of the three factors, experience had the weakest correlation of the three factors with usage with a .073. This suggests that initiatives to increase digital game usage in the classroom should be focused around improving teacher knowledge of the benefits of integrating games as a teaching tool, available games and resources, and learning about how to create learning experiences that involve teaching with them. There should also be a focus on improving teacher's perceptions about the benefits of using digital games for learning and taking steps to reduce any perceived barriers to implementation that may be getting in the way of a teacher wanting to take those steps towards implementation. While this data showed experience did not have as strong an influence on classroom game usage, teachers having positive experiences teaching with games can lead to increased implementation, thus providing them with opportunities and encouragement to try something new can help improve their perceptions about using this technology and want to continue to provide their students with these learning opportunities. Perceptions about accessibility of resources, having quality resources connected to curriculum, and knowing how to integrate them effectively are also important factors teachers consider regarding integration of other technologies such as Open Educational Resources (Zeichner, 2020).

RQ3: What effect does professional development have on factors that influence teachers' usage of GBL?

The data showed that professional development (PD) had positive correlations with all three identified and tested factors in the study (i.e., TP, KNOWL, and EXPG). PD had the strongest correlation with knowledge of games and teaching with games at

.802. The correlation between PD and teacher perceptions was .471 and between PD and experience teaching with games was .385. This suggests that receiving professional development on game-based learning strongly influences teachers' knowledge and usage of teaching with games. Increased professional development opportunities for teachers, including learning more about game-based learning, available resources for teaching with games, curriculum connections, and best practices and successful implementation can lead to higher integration of digital games in the classroom (Denham et al., 2016).

The importance of professional development is also evident in the qualitative data in this study where teachers indicated they have positive beliefs about the benefits and a desire to learn more about how to teach with games effectively, where to find the games that fit what they teach, and how to best find the time to do so. Professional development offerings should provide teachers with time for learning, exploring, and planning for the use of technologies such as digital games and others. This learning should not be thought of as a one-time thing, but an ongoing supportive process and the time needed to learn and be comfortable implementing an innovation will vary for each teacher (Lidtke, 1981). Another way to reach teachers and help them see the possibilities with GBL integration is through the learning standards. Teachers in the United States have a set of content learning standards they are responsible for teaching. Helping teachers make connections and see how integrating various technologies, including digital games, can help their students develop important skills but also still apply to content learning standards that they are likely more familiar with. School districts can help support their teachers in this endeavor by collaborating with educators that are regularly implementing GBL in their classrooms and specifically aligning these resources and ideas and making the

connections to specific learning standards. These alignments should be shared and included in curriculum documents and resources that teachers regularly use during their instructional planning and can be used to guide teachers on how to best use the technology to meet specific learning outcomes (Keene, 2022).

RQ4: What effect does prior experience teaching with games have on the factors that influence teachers' usage of GBL?

The data shows that prior experience teaching with games has positive correlations to the factors of TP, KNOWL, and EXPG. The strongest correlation of the three was between experience and EXPG, with a .933 regression estimate. This connection, while very strong, is also a bit misleading, because the survey questions related to prior experiences with games are part of both the EXP variable and the EXPG variable. The correlation between prior experience and TP was .425, and between prior experience and KNOWL was .396, both of which are moderate and positive correlations. This suggests that as teachers get more experience teaching with games in their classroom, especially positive experiences, it can have a positive influence on their knowledge and perceptions about the usefulness of games as a teaching tool, which can then lead to increased usage.

Hypothesis Testing

The following section lists the hypothesis of the study and discusses whether they are confirmed or denied by the survey data.

$H1_a$: Acceptance of game-based learning will influence the reported use of game-based learning.

$H1_0$: Acceptance of game-based learning will not influence the reported use of game-based learning.

H_1 is supported by the data. The data shows that the t value is as much as 5.803, thus the decision is to reject the null hypothesis and accept H_1. This means that there is a linear influence of the acceptance of GBL on reported usage. The amount of effect is .452, and the magnitude of this effect is significant because $p < .001$.

$H2_a$. Educator game knowledge, game pedagogical knowledge, and game pedagogical content knowledge will influence the use of digital games.

$H2_0$: Educator game knowledge, game pedagogical knowledge, and game pedagogical content knowledge will NOT influence the use of digital games.

H_2 is supported by the data. The data shows that the t value is as much as 8.853, thus the decision is to reject the null hypothesis and accept H_2. This means there is a linear influence of knowledge of GBL on reported usage. The amount of effect is .612, and the magnitude of this effect is statistically significant because $p <.001$. Knowledge had a .438 correlation with intention to use and a .204 direct influence on usage.

$H3_a$: Positive perceptions of GBL, including perceived usefulness, ease of use, and benefits for student learning will influence digital game usage.

$H3_0$: Positive perceptions of GBL, including perceived usefulness, ease of use, and benefits for student learning will NOT influence digital game usage.

H_3 is supported by the data. The data shows that the t value for EOU is as much as 5.276 and the t value for PU is 4.319. Thus, the decision is to reject the null hypothesis and accept H_3. The amount of effect on EOU is .344 and for PU is .421. The magnitude of the effect for both variables is statistically significant as $p < .001$.

$H4_a$: Teacher perception of the inflexibility of the curriculum, students' lack of readiness, fixed class schedules, lack of time, and limited infrastructures will influence digital game usage.

$H4_0$: Teacher perception of the inflexibility of the curriculum, students' lack of readiness, fixed class schedules, lack of time, and limited infrastructures will influence digital game usage.

H_4 is supported by the data. The data shows that the t value for perceived barrier is as much as 8.252, thus the decision is to reject the null hypothesis and accept H_4. The amount of effect on PB is .585, and the magnitude of this effect is statistically significant because $p < .001$. During analysis, these different variables were combined into a single factor, which was named "perceived barriers".

$H5_a$: Professional development to increase teachers' game pedagogical knowledge will influence their perceptions and knowledge of game-based learning and their experience teaching with games.

$H5_0$: Professional development to increase teachers' game pedagogical knowledge will NOT influence their perceptions and knowledge of game-based learning and their experience teaching with games.

H_5 is supported by the data. The data showed that professional development (PD) had positive correlations with all three factors that were identified and tested in the study (TP, KNOWL, and EXPG). PD had the strongest correlation with knowledge of games and teaching with games at .802. Correlation between PD and teacher perceptions was .471 and between PD and experience teaching with games was .385. Thus, the decision is to reject the null hypothesis and accept H_5.

$H6_a$. Prior experiences with games, preference for video games, and experiences teaching with video games will influence teacher perceptions and knowledge of game-based learning.

$H6_0$: Prior experiences with games, preference for video games, and experiences teaching with video games will NOT influence teacher perceptions and knowledge of game-based learning.

H6 is supported by the data. Correlation between prior experience and teacher perceptions was .425, and between prior experience and knowledge was .396, both of which are moderate and positive correlations. Thus, the decision is to reject the null hypothesis and accept H_6.

While this is a strong correlation, there is a difference between intending to use GBL and actual classroom usage.

Suggestions

In this section, I provide suggestions to help improve the research, suggestions for improving professional development on GBL, and suggestions of considerations for future research on this topic.

Suggestions to Improve Research

While the survey instrument was reliable and I had a large sample size, there were still some limitations to this research. Within this study, 133 teachers completed the survey, which was a good sample according to the KMO measure of sampling adequacy (Glen, 2016) and within the desired range of 80 to 160 participants (Kline, 1998). However, 19 (14%) of those participants did not finish the survey which left some incomplete data. While a small number that did not detract from the overall results, it is possible those participants experienced fatigue from the length of the survey. Shortening the length of the survey by combining a few similar questions or possibly removing questions from variables determined not to have a strong correlation with usage could lead to more complete responses the next time this survey was administered. I would also in the future like to have additional educators pilot the survey instrument and provide them with a Likert scale survey to complete as part of their evaluation. This change will help increase the face validity of the survey instrument in future studies.

Participants were primarily from one school district. Although the intent and hope of this study was to be able to reach beyond the scope of a single school district or region, the lack of participants limits the generalizability of the study results. If the study was to be conducted again, extending the scope of the sample and length of the data collection period could lead to a more varied and random sample size for discussion.

Suggestions for Professional Development on Game-based Learning

One purpose of this study discussed in Chapter One was to make suggestions for how to convince reluctant teachers to try implementing GBL and digital games into their classroom instruction. Both prior research and participants in this study have indicated that professional development focused on the integration of digital games would be a great avenue for increasing quality classroom implementation of digital games.

Well-designed professional development on GBL should be focused, incorporate active learning, provide opportunities for collaboration, support effective practice, and offer opportunities for teachers to practice and have ongoing support to continue growth (Darling-Hammond et al., 2017). Engaging in opportunities to learn about available games, how they work, ways to integrate the game(s) with learning content, and where to seek ongoing resources and support can help change teachers' perceptions and decrease perceived barriers to implementing digital games in their classroom (Runciman, 2019; Shah & Foster, 2015). Traditional PD offerings should not be the only method of game-based learning PD, however, and multiple flexible options should be made available to reach more educators and provide them with opportunities to learn about GBL integration.

The results of this study indicated a positive correlation between knowledge of games and teaching with games and reported usage. Ongoing professional development for teachers should help them learn about games, how they work, and how they can be integrated along with the content they teach. PD should also provide teachers with existing lesson plans and resources to help them get started and should provide ongoing support and opportunities for growth.

Suggestions for Future Research

This study explored and identified factors that can impact educators' decisions to implement GBL and use digital games as a teaching tool in their classrooms. While results show that many teachers are using digital games in their classrooms at least once per week, a deeper dive into how and what types of games were used was outside the scope of this study. Future research into this topic would be beneficial to better understand why and how educators use games as a tool to support the learning process for students. It would also be beneficial to understand the decisions of those educators who reported not using digital games in their classrooms and those who do not seek out PD opportunities to learn more about digital games. In addition, the focus of this study on GBL was on digital games. Perhaps tweaking the focus slightly and altering the survey to include responses about non-digital games could invite additional participants who may have experience with or use games but not digital games to share their experiences. Lastly, future research on the topic of GBL could also explore specific games or integrations to identify best instructional practices and determine connections to learning or student academic performance. To determine if the findings of the study can be generalized more broadly, it would be beneficial to conduct this same study in other contexts across the United States.

Conclusion

This study contributed to existing research on game-based learning and findings can be used to help improve the intention to use GBL and lead to increased usage in the classroom. Educators and school administrators should be aware of the benefits of GBL and the factors that influence the adoption of digital games as an instructional tool. A survey-based research survey was administered to current K-12 educators to learn their perceptions about teaching with digital games, knowledge and experiences, perceived barriers to implementation, and how often they use games for learning in their classroom.

Findings from this study show that teachers are integrating digital games into their classrooms. They believe that digital games are beneficial learning tools as using games can help a student's engagement and motivation to learn. The findings indicate that while regular classroom usage of digital games is taking place, some obstacles prevent teachers from taking the risk themselves, including time, classroom management during game-based instruction, and teacher knowledge. This current study showed that in the context of GBL, the factors of teacher perceptions, knowledge of games and teaching with games, and experiences with games all influence teacher's decisions to use digital games as part of their classroom instruction. The tested hypotheses were all supported by the data. Continued research is needed to dig deeper on the types of games used by teachers and how they are used for instruction.

Increased professional learning opportunities and resources for teachers can help those that are resistant improve their knowledge and confidence and overcome those obstacles to leverage digital games to add an engaging and effective element to their classroom instruction. Knowledge of games and how to teach with them, and experiences

teaching with games can positively affect the factors that influence teachers' decisions and actual usage of digital games in the classroom. If teachers feel they have the access, ability, and resources to integrate game-based learning into their instruction, they may be more likely to do so, and their students will likely benefit as a result.

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APPENDIX A

View IRB Approval Letter

BOISE STATE UNIVERSITY
RESEARCH AND ECONOMIC DEVELOPMENT

Date: June 04, 2021

To: Youngkyung Baek **cc:** Sean Ward

From: Office of Research Compliance (ORC)

Subject: SB-IRB Notification of Exemption - 101-SB21-100

Game-Based Learning: Examining K-12 Educator Perspectives, Knowledge, and Classroom Usage

The Boise State University ORC has reviewed your protocol application and has determined that your research is exempt from further IRB review and supervision under 45 CFR 46.101(b).

Protocol Number: 101-SB21-100 Received: 5/25/2021 Review: Exempt
Expires: 6/3/2024 Approved: 6/4/2021 Category: 2

This exemption covers any research and data collected under your protocol as of the date of approval indicated above, unless terminated in writing by you, the Principal Investigator, or the Boise State University IRB. All amendments or changes (including personnel changes) to your approved protocol must be brought to the attention of the Office of Research Compliance for review and approval before they occur, as these modifications may change your exempt status. Complete and submit a Modification Form indicating any changes to your project.

Exempt protocols are set to expire after three years. Annual renewals are not required for exempt protocols. If the research project will continue beyond three years, a new application must be submitted for review. If the research project is completed before the expiration date, please notify our office by submitting a Final Report.

All forms are available on the ORC website at http://goo.gl/D2FYTV

Please direct any questions or concerns to ORC at 426-5401 or humansubjects@boisestate.edu.

Thank you and good luck with your research.

Office of Research Compliance

1910 University Drive Boise, Idaho 83725-1138
Phone (208) 426-5401 orc@boisestate.edu

APPENDIX B

Survey Consent

My name is Sean Ward and I am a doctoral candidate at Boise State University. My advising professor at Boise State is Dr. Youngkyun Baek. I am inviting you to participate in this research study.

The title of this study is “Game-Based Learning: Examining K-12 Educator Perspectives and Knowledge”. This research seeks to understand current educator beliefs about why they do or do not implement the use of digital games in their classroom and what factors may impact changes to those perceptions over time. The results of this research will be used to help inform the improvement of current professional development regarding game-based learning.

Your participation in this study will involve taking a survey about your experiences and knowledge with game-based learning. This survey could take 20-25 minutes to complete.

The risks to you as a participant are minimal. These include the chance that your survey answers could be linked back to your email address. To minimize the risk, email and other identifying information will be discarded after the survey results are coded. The survey results will be aggregated, or combined, and not kept at an individual level.

The results of this study will be published in a dissertation and possibly in scientific research journals or presented at professional conferences. However, your name and identity will not be revealed, and your record will remain anonymous.

While there is no direct benefit to individuals who participate in the survey, participation may benefit you indirectly by improving the body of knowledge regarding game-based learning and specifically professional development for teachers in this area.

You can choose not to participate. If you decide not to participate, there will be no penalty to you or loss of any benefits to which you are otherwise entitled. You may withdraw from this study at any point during the survey. Simply close the window before hitting the submit button to withdraw.

If you have questions about this research study, you can email Sean Ward at seanward519@u.boisestate.edu or call Professor Youngkyun Baek at 208-426-1023. If you have questions about your rights as a research participant, you can call the Boise State Institutional Review Board at 208-426-5871.

APPENDIX C

Recruitment Email

My name is Sean Ward and I am a doctoral candidate at Boise State University. I am inviting you to participate in a research study regarding educator use of game-based learning in the classroom.

Your participation in this study will involve taking a survey on your interactions with digital learning games. This survey could take 20-25 minutes to complete.

This survey is anonymous. The combined results of the survey will be published in a dissertation. No individual results will be included; all scores will be combined.

The only requirement for participants is that they are currently practicing educators in K-12 education.

I am needing to gather data from at least 100 current educators. You can choose not to participate, but if you are willing to help me reach that goal, please follow the link below to the online survey.

Thank you for your time!

Sean Ward

APPENDIX D

Boise State Recruitment Email

Greetings fellow graduate students!

My name is Sean Ward, and I am a doctoral candidate in Boise State's educational technology department. I am inviting currently practicing K-12 educators to complete a brief survey on implementation of game-based learning in the classroom.

The survey has ___ questions and takes about 20 minutes to complete. Participation is voluntary and anonymous. The combined results of the survey will be published in my dissertation>

I really appreciate your help in completing this research. Thank you for your time!

Sean Ward

APPENDIX E

Dissertation Survey Instrument

All questions unless otherwise noted are on 5-point Likert scale (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)

I have read the informed consent and I am a current K-12 educator who agrees to participate in this survey. (Yes No)

Demographic data

1. Your Name _____
2. Teaching Experience (0-3 years 4-6 years 7-9 years 10-13 years 14 + years
3. Grade level you primarily teach (elementary school middle school high school)
4. Subject you primarily teach (all subjects math language arts science social studies foreign language physical education art music drama cte other)

Teacher perceptions of GBL

1. I like playing digital games.
2. I have played digital games to learn something.
3. I like to use digital games in my classroom.
4. If I could, I would use more digital games in my classroom.
5. Resources of digital games can enrich course content.
6. Digital game-based learning can enhance students' learning motivation.
7. Digital games can actually be used in the practice of teaching.

Potential Barriers

8. I can find one or more digital games suitable for a given learning objective.
9. I can locate a digital games that focuses on learning.
10. I can control my students' use of digital games once they are immersed in playing them.
11. Students are skilled enough with digital games to learn from them in a classroom.
12. There is enough time for students to learn how to use a digital game in the classroom.
13. The time allotted for the curriculum would allow me to teach using digital games.
14. The time allotted in a given class period makes it possible to play digital games during a class.
15. School computing technologies are powerful enough to run digital games.

16. School IT personnel would support the installation and updating of digital games on computers.
17. Administration would support my use of digital games for learning.
18. I have easy access to computers or other hardware (iPads etc.) that would allow my students to play digital games during my class.

Usage

19. On average, how many times a week will your students use digital games in your classroom for any reason (including rewards for finishing work)? (0 1 2-3 4-5 More than 5)
20. On average, how many times a week will your students use digital games in your classroom as a primary means of learning content? (0 1 2-3 4-5 More than 5)
21. On average, how many times a week will your students use digital games in your classroom as a supplemental means of learning content? (0 1 2-3 4-5 More than 5)
22. On average, how many times a week will your students use digital games in your classroom as a reward for finishing work, good behavior, etc.? (0 1 2-3 4-5 More than 5)

Teacher Knowledge about Games and Teaching with Games

23. I know how to solve my own technical problems when using digital games.
24. I can design lessons that appropriately integrate content, digital games, and pedagogy for student-centered learning.
25. I can craft real world problems about the content knowledge and represent them through digital games to engage my students.
26. I can teach lessons that appropriately combine my teaching subject, digital games, and teaching approaches.
27. I can select digital games to use in my classroom that enhance what I teach, how I teach, and what students learn.

GBL Professional Development

28. I have received professional development on teaching with games.
29. How did you first learn about using games in the classroom?
30. How many hours of professional development have you received in the last 12 months?
31. Where do you go to seek PD on using digital games in the classroom?

Open-Ended Questions

32. What are your perceptions/views on using games in the classroom to teach content to students?
33. In what ways has game-based learning impacted your traditional teaching of content?

34. Thinking about your students, in what ways have you seen or identified that using game-based learning may have impacted their learning, especially with skill(s) development?
35. What, if anything, do you see as an obstacle to integrating game-based learning in your classroom?
36. Where do you go for additional professional development to increase your knowledge about using games for instruction in your classroom?

APPENDIX F

Variable Names and Data Types

Construct	Survey Item	Variable Item	Variable Type
Experience with Games	I would describe myself as a gamer.	EXP1	Ordinal
	I like playing digital games.	EXP2	Ordinal
	I play digital games often (at least once per week).	EXP3	Ordinal
	I teach using digital games often (at least once per week).	EXP4	Ordinal
Teacher Acceptance of GBL	I have played digital games to learn something.	ACC1	Ordinal
	I like to use digital games in my classroom.	ACC2	Ordinal
	If I could, I would use more digital games in my classroom.	ACC3	Ordinal
	If I had the choice, I would choose to take a course in which digital games are used.	ACC4	Ordinal
Perceived Usefulness	Resources of digital games can enrich course content.	PU1	Ordinal
	Digital game-based learning can enhance	PU2	Ordinal

	students' learning motivation.		
	Digital games can actually be used in the practice of teaching.	PU3	Ordinal
	What are your perceptions/views on using games in the classroom to teach content to students?	PU4	Qualitative
Perceived Barriers	I can find one or more digital games suitable for a given learning objective.	PB1	Ordinal
	I can locate a digital game that focuses on learning.	PB2	Ordinal
	I can control my students' use of digital games once they are immersed in playing them.	PB3	Ordinal
	Students are skilled enough with digital games to learn from them in a classroom.	PB4	Ordinal
	There is enough time for students to learn how to use a digital game in the classroom.	PB5	Ordinal
	The time allotted for the curriculum would allow me to teach using digital games.	PB6	Ordinal

	The time allotted in a class period makes it possible to play digital games during a class.	PB7	Ordinal
	School computing technologies are powerful enough to run digital games.	PB8	Ordinal
	I have easy access to computers or other hardware (iPads etc.) that would allow my students to play digital games during my class.	PB9	Ordinal
	What, if anything, do you see as an obstacle to integrating digital games for learning in your classroom?	PB10	Qualitative
Behavioral Intention to Use	Assuming I had access to digital games for my students to use for learning, I intend to use them.	BI1	Ordinal
Usage	On average, how many times a week will your students use digital games in your classroom for any reason (including rewards for finishing work)?	USE1	Ordinal
	On average, how many times a week will your students use digital games in your classroom as a	USE2	Ordinal

	primary means of learning content?		
	On average, how many times a week will your students use digital games in your classroom as a supplemental means of learning content?	USE3	Ordinal
	On average, how many times a week will your students use digital games in your classroom as a reward for finishing work early, good behavior, etc.	USE4	Qualitative
	In what ways has game-based learning impacted your traditional teaching of content?	USE5	Qualitative
Ease of Use	I know how to solve my own technical problems when using digital games.	EOU1	Ordinal
	I am knowledgeable about managing digital games in my classroom.	EOU2	Ordinal
	I understand how to implement digital games in my classroom.	EOU3	Ordinal
Knowledge	I can design lessons that appropriately integrate content, digital games, and pedagogy for	KNOW1	Ordinal

	student-centered learning.		
	I can craft real world problems about content knowledge and represent them through digital games to engage my students.	KNOW2	Ordinal
	I can teach lessons that appropriately combine my teaching subject, digital games, and teaching approaches.	KNOW3	Ordinal
	I can select digital games to use in my classroom to enhance what I teach, how I teach, and what students learn.	KNOW4	Ordinal
	Thinking about your students, in what ways have you seen or identified that using digital games for learning may have impacted their learning, especially with skill(s) development?	KNOW5	Ordinal
GBL Professional Development	I have received professional development on teaching with games.	PD1	Ordinal
	How did you first learn about using games in the classroom?	PD2	Categorical

	How many hours of PD about teaching with games have you received in the last 12 months?	PD3	Ordinal
	Where do you go to seek PD on using digital games in the classroom?	PD4	Categorical
	What professional development would you like to receive to help you become more comfortable integrating digital games into your classroom?	PD5	Qualitative

APPENDIX G

Item Analysis of Survey Questions

	N	Minimum	Maximum	Mean	Std.Deviation
EXP1	133	0	5	2.14	1.324
EXP2	133	0	5	3.07	1.327
EXP3	133	0	5	2.66	1.456
EXP4	133	0	5	2.74	1.403
ACC1	133	0	5	3.23	1.353
ACC2	133	0	5	3.50	1.277
ACC3	133	0	5	3.77	1.210
ACC4	133	0	5	3.56	1.270
PU1	133	0	5	3.74	1.359
PU2	133	0	5	3.94	1.369
PU3	133	0	5	3.71	1.449
PB1	133	0	5	2.84	1.440
PB2	133	0	5	3.21	1.425
PB3	133	0	5	2.99	1.340
PB4	133	0	5	3.46	1.390
PB5	133	0	5	2.87	1.432
PB6	133	0	5	2.73	1.415
PB7	133	0	5	2.93	1.468
PB8	133	0	5	3.08	1.418
PB9	133	0	5	3.36	1.350
PB10	133	0	5	3.59	1.558
USE1	133	0	5	2.42	1.388

EOU1	133	0	5	2.55	1.612
EOU2	133	0	5	2.59	1.591
EOU3	133	0	5	2.76	1.643
KNOW1	133	0	5	2.77	1.631
KNOW2	133	0	5	2.52	1.570
KNOW3	133	0	5	2.85	1.667
KNOW4	133	0	5	2.87	1.681
PD1	133	0	5	1.76	1.431

APPENDIX H

Rotated Component Matrix Chart

Survey Question	Component 1	Component 2	Component 3
The time allotted for the curriculum would allow me to teach using digital games.	.834		
Students are skilled enough with digital games to learn from them in a classroom.	.834		
Administration would support my use of digital games for learning.	.834		
The time allotted in a given class period makes it possible to play digital games during a class.	.833		
School computing technologies are powerful enough to run digital games.	.830		
There is enough time for students to learn how to use a digital game in the classroom.	.825		
I can control my students' use of digital games once they are immersed in playing them.	.807		
I have easy access to computers or other hardware (iPads etc.) that would allow my students to play digital games during my class.	.806		
I can locate a digital game that focuses on learning.	.778	.408	
I can find one or more digital games suitable for a given learning objective.	.769	.417	
Resources of digital games can enrich course content.	.764		.412
Digital game-based learning can enhance students' learning motivation.	.750		

Digital games can actually be used in the practice of teaching.	.690		
I understand how to implement digital games in my classroom.		.876	
I can teach lessons that appropriately combine my teaching subject, digital games, and teaching approaches.		.873	
I am knowledgeable about managing digital games in my classroom.		.871	
I can design lessons that appropriately integrate content, digital games, and pedagogy for student-centered learning.		.870	
I can select digital games to use in my classroom that enhance what I teach, how I teach, and what students learn.		.867	
I can craft real world problems about content knowledge and represent them through digital games to engage my students.		.866	
I know how to solve my own technical problems when using digital games.		.848	
I have received professional development on teaching with games.		.837	
If I had the choice, I would choose to take a course in which digital games are used.			.843
If I could, I would use more digital games in my classroom.			.837
I like playing digital games.			.821
I have played digital games to learn something.			.817
I would describe myself as a gamer.			.810

I like to use digital games in my classroom.			.809
I play digital games often (at least once per week)			.794
I teach using digital games often (at least once per week)			.727
Extraction Method: Principal Component Analysis Rotation Method: Varimax with Kaiser Normalization Rotation converged in 6 iterations			

APPENDIX I

Item-Total Correlation Testing Results

Correlations

		I would describe myself as a gamer.	I like playing digital games.	I play digital games often (at least once per week).	I teach using digital games often (at least once per week).	EXP
I would describe myself as a gamer.	Pearson Correlation	1	.697**	.578**	.284**	.787**
	Sig. (2-tailed)		<.001	<.001	<.001	<.001
	N	133	133	133	133	133
I like playing digital games.	Pearson Correlation	.697**	1	.804**	.445**	.912**
	Sig. (2-tailed)	<.001		<.001	<.001	<.001
	N	133	133	133	133	133
I play digital games often (at least once per week).	Pearson Correlation	.578**	.804**	1	.383**	.863**
	Sig. (2-tailed)	<.001	<.001		<.001	<.001
	N	133	133	133	133	133
I teach using digital games often (at least once per week).	Pearson Correlation	.284**	.445**	.383**	1	.660**
	Sig. (2-tailed)	<.001	<.001	<.001		<.001
	N	133	133	133	133	133
EXP	Pearson Correlation	.787**	.912**	.863**	.660**	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	
	N	133	133	133	133	133

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

		I have played digital games to learn something.	I like to use digital games in my classroom.	If I could, I would use more digital games in my classroom.	If I had the choice, I would choose to take a course in which digital games are used.	ACC
I have played digital games to learn something.	Pearson Correlation	1	.651**	.606**	.568**	.823**
	Sig. (2-tailed)		<.001	<.001	<.001	<.001
	N	133	133	133	133	133
I like to use digital games in my classroom.	Pearson Correlation	.651**	1	.745**	.641**	.876**
	Sig. (2-tailed)	<.001		<.001	<.001	<.001
	N	133	133	133	133	133
If I could, I would use more digital games in my classroom.	Pearson Correlation	.606**	.745**	1	.802**	.904**
	Sig. (2-tailed)	<.001	<.001		<.001	<.001
	N	133	133	133	133	133
If I had the choice, I would choose to take a course in which digital games are used.	Pearson Correlation	.568**	.641**	.802**	1	.865**
	Sig. (2-tailed)	<.001	<.001	<.001		<.001
	N	133	133	133	133	133
ACC	Pearson Correlation	.823**	.876**	.904**	.865**	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	
	N	133	133	133	133	133

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

		Digital game-based learning can enhance students' learning motivation.	Digital games can actually be used in the practice of teaching.	I can find one or more digital games suitable for a given learning objective.	PU
Digital game-based learning can enhance students' learning motivation.	Pearson Correlation	1	.866**	.625**	.963**
	Sig. (2-tailed)		<.001	<.001	<.001
	N	133	133	133	133
Digital games can actually be used in the practice of teaching.	Pearson Correlation	.866**	1	.628**	.954**
	Sig. (2-tailed)	<.001		<.001	<.001
	N	133	133	133	133
I can find one or more digital games suitable for a given learning objective.	Pearson Correlation	.625**	.628**	1	.666**
	Sig. (2-tailed)	<.001	<.001		<.001
	N	133	133	133	133
PU	Pearson Correlation	.963**	.954**	.666**	1
	Sig. (2-tailed)	<.001	<.001	<.001	
	N	133	133	133	133

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

		I know how to solve my own technical problems when using digital games.	I am knowledgable about managing digital games in my classroom.	I understand how to implement digital games in my classroom.	EOU
I know how to solve my own technical problems when using digital games.	Pearson Correlation	1	.891**	.846**	.948**
	Sig. (2-tailed)		<.001	<.001	<.001
	N	133	133	133	133
I am knowledgable about managing digital games in my classroom.	Pearson Correlation	.891**	1	.925**	.976**
	Sig. (2-tailed)	<.001		<.001	<.001
	N	133	133	133	133
I understand how to implement digital games in my classroom.	Pearson Correlation	.846**	.925**	1	.961**
	Sig. (2-tailed)	<.001	<.001		<.001
	N	133	133	133	133
EOU	Pearson Correlation	.948**	.976**	.961**	1
	Sig. (2-tailed)	<.001	<.001	<.001	
	N	133	133	133	133

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

		I can find one or more digital games suitable for a given learning objective.	I can locate a digital game that focuses on learning.	I can control my students' use of digital games once they are immersed in playing them.	Students are skilled enough with digital games to learn from them in a classroom.	There is enough time for students to learn how to use a digital game in the classroom.	The time allotted for the curriculum would allow me to teach using digital games.	The time allotted in a given class period makes it possible to play digital games during a class.	School computing technologies are powerful enough to run digital games.	Administration would support my use of digital games for learning.	I have easy access to computers or other hardware (iPads etc.) that would allow my students to play digital games during my class.	PB
I can find one or more digital games suitable for a given learning objective.	Pearson Correlation	1	.840**	.702**	.725**	.611**	.611**	.629**	.648**	.672**	.653**	.820**
	Sig. (2-tailed)		<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
	N	133	133	133	133	133	133	133	133	133	133	133
I can locate a digital game that focuses on learning.	Pearson Correlation	.840**	1	.770**	.808**	.622**	.603**	.648**	.742**	.767**	.708**	.867**
	Sig. (2-tailed)	<.001		<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
	N	133	133	133	133	133	133	133	133	133	133	133
I can control my students' use of digital games once they are immersed in playing them.	Pearson Correlation	.702**	.770**	1	.836**	.710**	.654**	.670**	.710**	.734**	.674**	.860**
	Sig. (2-tailed)	<.001	<.001		<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
	N	133	133	133	133	133	133	133	133	133	133	133
Students are skilled enough with digital games to learn from them in a classroom.	Pearson Correlation	.725**	.808**	.836**	1	.764**	.715**	.702**	.736**	.831**	.739**	.906**
	Sig. (2-tailed)	<.001	<.001	<.001		<.001	<.001	<.001	<.001	<.001	<.001	<.001
	N	133	133	133	133	133	133	133	133	133	133	133
There is enough time for students to learn how to use a digital game in the classroom.	Pearson Correlation	.611**	.622**	.710**	.764**	1	.861**	.810**	.669**	.702**	.682**	.859**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001		<.001	<.001	<.001	<.001	<.001	<.001
	N	133	133	133	133	133	133	133	133	133	133	133
The time allotted for the curriculum would allow me to teach using digital games.	Pearson Correlation	.611**	.603**	.654**	.715**	.861**	1	.830**	.683**	.722**	.691**	.852**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001		<.001	<.001	<.001	<.001	<.001
	N	133	133	133	133	133	133	133	133	133	133	133
The time allotted in a given class period makes it possible to play digital games during a class.	Pearson Correlation	.629**	.648**	.670**	.702**	.810**	.830**	1	.712**	.735**	.720**	.863**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001	<.001		<.001	<.001	<.001	<.001
	N	133	133	133	133	133	133	133	133	133	133	133
School computing technologies are powerful enough to run digital games.	Pearson Correlation	.648**	.742**	.710**	.736**	.669**	.683**	.712**	1	.765**	.831**	.867**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001	<.001	<.001		<.001	<.001	<.001
	N	133	133	133	133	133	133	133	133	133	133	133
Administration would support my use of digital games for learning.	Pearson Correlation	.672**	.767**	.734**	.831**	.702**	.722**	.735**	.765**	1	.777**	.890**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001		<.001	<.001
	N	133	133	133	133	133	133	133	133	133	133	133
I have easy access to computers or other hardware (iPads etc.) that would allow my students to play digital games during my class.	Pearson Correlation	.653**	.708**	.674**	.739**	.682**	.691**	.720**	.831**	.777**	1	.867**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001		<.001
	N	133	133	133	133	133	133	133	133	133	133	133
PB	Pearson Correlation	.820**	.867**	.860**	.906**	.859**	.852**	.863**	.867**	.890**	.867**	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	
	N	133	133	133	133	133	133	133	133	133	133	133

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

		I can design lessons that appropriately integrate content, digital games, and pedagogy for student-centered learning.	I can craft real world problems about content knowledge and represent them through digital games to engage my students.	I can teach lessons that appropriately combine my teaching subject, digital games, and teaching approaches.	I can select digital games to use in my classroom that enhance what I teach, how I teach, and what students learn.	KNOW
I can design lessons that appropriately integrate content, digital games, and pedagogy for student-centered learning.	Pearson Correlation	1	.886**	.940**	.910**	.969**
	Sig. (2-tailed)		<.001	<.001	<.001	<.001
	N	133	133	133	133	133
I can craft real world problems about content knowledge and represent them through digital games to engage my students.	Pearson Correlation	.886**	1	.898**	.867**	.945**
	Sig. (2-tailed)	<.001		<.001	<.001	<.001
	N	133	133	133	133	133
I can teach lessons that appropriately combine my teaching subject, digital games, and teaching approaches.	Pearson Correlation	.940**	.898**	1	.937**	.979**
	Sig. (2-tailed)	<.001	<.001		<.001	<.001
	N	133	133	133	133	133
I can select digital games to use in my classroom that enhance what I teach, how I teach, and what students learn.	Pearson Correlation	.910**	.867**	.937**	1	.964**
	Sig. (2-tailed)	<.001	<.001	<.001		<.001
	N	133	133	133	133	133
KNOW	Pearson Correlation	.969**	.945**	.979**	.964**	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	
	N	133	133	133	133	133

**. Correlation is significant at the 0.01 level (2-tailed).