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Digital Game-Based Learning:

Teacher Training, Perceptions, Benefits, and Barriers

by

Aspen Easterling

A Dissertation

Submitted to the Graduate Faculty of

St. Cloud State University

in Partial Fulfillment of the Requirements

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Abstract

The purpose of this quantitative study was to determine current teacher training practices, both preservice teacher preparation programs and school district professional development, aligned to digital game-based learning (DGBL). The study surveyed Northern Minnesota teachers in grades P-12 to determine their perceptions related to the benefits of DGBL and the barriers they face to the implementation of DGBL. Respondents (N = 345) rated trainings, resources, and supports which they felt would encourage their use of digital games to deliver educational content and facilitate learning.

The results of the study revealed the majority of respondents perceived numerous benefits to DGBL including: (a) the use of digital games as supplemental learning activities (89.48%); (b) to provide instantaneous feedback to learners (86.51%); and (c) to motivate students (85.50%). Respondents ranked the cost of purchasing games or licenses (81.23%) and the cost of equipment (80.35%) as the top two deterrents to the implementation of DGBL. The study showed a lack of teacher training, both in teacher preparation programs (75.00%) and school district professional development (77.52%) aligned to the use of digital games in the classroom.

The findings of this study contribute to existing research outlining the lack of teacher training aligned to the integration of digital games into the classroom. This study concludes with recommendations for school administrators including: (a) professional development offerings aligned to DGBL; (b) technology support personnel to provide ongoing support; and (c) time designated specifically for the exploration of digital games and to plan for their use in the classroom.

Acknowledgment

I would like to express my gratitude to my committee members, Dr. Lund, Dr. Johnson, Dr. Miltenoff, and Dr. Goodwin, for their feedback, guidance, and support throughout my dissertation journey. To Dr. Min Lun Wu, thank you for granting permission to repurpose your study. I would also like to thank the P-12 school administrators who supported my study and the P-12 teachers who completed the survey. Teachers and administrators face immense challenges and demands on their time during an average school year and this year was all the more difficult due to the COVID-19 pandemic. Thank you, teachers, for your input, for taking the time to complete the survey, and for all you do to mold students into reflective and conscientious adults.

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Chapter 1: Introduction to the Study

Introduction

Play is vital to the development of children (Ginsburg, 2007; Vygotsky, 1967), providing opportunities to cultivate imagination (Ginsburg, 2007), express creativity, and practice what they are learning (Rogers & Sharapan, 1994). “Play is a very serious matter, indeed. It is an expression of our creativity; and creativity is at the very root of our ability to learn, to cope, and to become whatever we may be” (Rogers & Sharapan, 1994, para. 1). Play takes place within a set of rules (Vygotsky, 1967) and is a significant component of games (Salen & Zimmerman, 2004). Games are contests, bound by a set of rules (Avedon & Sutton-Smith, 1979; Fullerton et al., 2008; Hogle, 1996; Prensky, 2001; Salen & Zimmerman, 2004), with goals or objectives (Fullerton et al., 2008; Hogle, 1996; McGonigal, 2011; Prensky, 2001), resulting in measurable outcomes (Fullerton et al., 2008; Prensky, 2001; Salen & Zimmerman, 2004).

Digital games are defined as electronic games played on gaming consoles, personal computers, and portable devices such as iPads, Chromebooks, or smartphones (Stieler-Hunt & Jones, 2015). Digital games are uniquely suited to provide authentic contexts, teach complex thinking skills, support a variety of learning styles (Schrier, 2014), and encourage collaboration and innovation (Gee & Shaffer, 2010). Advocates for the use of digital games in education highlight the capability of digital games to incorporate play and to provide simulated environments for learning and assessment (Ke, 2009; McClarty et al., 2012). Further support for the use of digital games in education has been based on their ability to engage (Chmiel, 2015; de Byl, 2013; Gee, 2013) and motivate learners (Karagiorgas & Niemann, 2017; Tsai et al., 2015). Digital games offer opportunities for social development (Chmiel, 2015; de Byl, 2013; Monem, 2015) while allowing learners to exercise critical-thinking and problem-solving skills (Chuang &

Chen, 2009; Hogle, 1996; Karagiorgas & Niemann, 2017; Ke, 2009; Kulman et al., 2014). Digital games provide ongoing, real-time feedback (McGonigal, 2011; Tsai et al., 2015; Weitze, 2014), opportunities for differentiation (Malykhina, 2014; Salen et al., 2011; Weitze, 2014), and autonomy (De Grove et al., 2012; Egenfeldt-Nielsen, 2006; Merkel & Sanford, 2011), while promoting new forms of literacy (Compaine, 1983; Gee, 2003).

According to Alan Gershenfeld, co-founder and president of digital game publisher E-Line Media, “digital literacy and understanding how systems (computer and otherwise) work will become increasingly important in a world where many of today’s students will pursue jobs that do not currently exist” (Malykhina, 2014, para. 9). Innovative methods of instruction are needed to support learners' achievement of critical-thinking, problem-solving, communication, and collaboration skills (Darling-Hammond et al., 2017). Educators are more comfortable and confident using digital games after receiving professional development related to their application in the classroom (An, 2018). Appropriate teacher training and professional development are necessary for successful classroom implementation (Darling-Hammond et al., 2017).

Statement of the Problem

A review of the literature revealed a lack of educator training, both pre-service teacher preparation and in-service professional development, related to the use of digital games in education (An, 2018; Groff, 2018; Meredith, 2016; Takeuchi & Vaala, 2014). Teacher preparation programs lack appropriate training aligned to digital game usage (Angeli, 2005; Becker, 2007; Denham, 2019; Takeuchi & Vaala, 2014). Additionally, professional development delivered to in-service teachers fails to provide educators with: (a) relevant examples of successful implementation (Ketelhut & Schifter, 2011; Stieler-Hunt & Jones, 2019) in their content area (Kenny & McDaniel, 2011; Stieler-Hunt & Jones, 2019); (b) the necessary time to familiarize themselves with potential games (Perrotta et al., 2013); (c) ongoing professional development (Perrotta et al., 2013; Stieler-Hunt & Jones, 2015; Stieler-Hunt & Jones, 2019); or (d) real-time support to successfully implement digital game-based learning in their classrooms (Ketelhut & Schifter, 2011; Stieler-Hunt & Jones, 2019). Teachers prepared to implement digital games in their classrooms are more likely to do so (De Grove et al., 2012; Stieler-Hunt & Jones, 2019).

Purpose of the Study

The purpose of this study was to determine the current professional development practices, related to digital game-based learning, in select Northern Minnesota P-12 schools. This study also identified Northern Minnesota teachers’ perceived barriers and benefits to the implementation of digital games and immersive learning in the classroom. Results of this study may provide administrators with insights to trainings, resources, and supports related to digital game-based learning.

Research Questions

The following research questions were used to guide this study:

1. What forms of training and to what extent do select Minnesota teachers in grades P-12 report receiving related to the integration of digital games into their curriculum?
2. What do select Minnesota teachers in grades P-12 report as the benefits of integrating educational digital games into their curriculum?

3. What do select Minnesota teachers in grades P-12 report as barriers to the integration of educational digital games into their curriculum?
4. What do select Minnesota teachers in grades P-12 report as the needed resources, supports, and trainings related to the integration of educational digital games into their curriculum?

Assumptions of the Study

This study assumed respondents provided honest answers which reflected their professional experiences and opinions associated with the implementation of digital game-based learning. This study also assumed principals and superintendents forwarded the survey link to P-12 teachers in their schools.

Delimitations of the Study

Delimitations of the study include:

1. The survey was conducted using select Northern Minnesota P-12 schools.
2. The participants were classroom teachers, surveyed during the school year.
3. Teachers were surveyed between November and December 2020, during the COVID-19 pandemic.

Definition of Terms

Augmented Reality (AR): combines elements of the real world and virtual world (Dede, 2009); “real world remains central to the experience, enhanced by virtual details” (ICRC, 2018, p. 2); “provide[s] virtual objects and backgrounds, which are simultaneously projected on the real world, to create the sensation of immersion” (Lu & Liu, 2015).

Badges: recognize successful completion of skills or tasks and serve as status symbols amongst players (de Byl, 2013).

Cognitive Load Theory: theory related to mental capacity, and “the exploration of the impact of an individual’s total load on his or her own accomplishment of a specific task and the benefits of his or her information processing” (Liao et al., 2019, p. 45).

Commercial Off-The-Shelf (COTS) Games: games designed with entertainment, not education, in mind; may be more engaging and motivating than games designed specifically for educational use (Van Eck, 2009; Wouters et al., 2013).

Constructivist Learning Theory: theory stating students construct their knowledge from the world around them using inquiry-based methods situated in authentic experiences (Cox, 2018; Hmelo-Silver, 2004; Otting & Zwaal, 2007; Plass et al., 2016; Rich & Reeves, 2006; UCD, n.d.).

Digital Game (Video Game): the terms digital game and video game were used interchangeably throughout this paper when discussing electronic games played on gaming consoles (e.g., PlayStation, Nintendo, Xbox, etc.), personal computers, portable devices (e.g., iPads, Chromebooks, smartphones, etc.; Stieler-Hunt & Jones, 2015), or immersive learning technologies such as augmented reality or virtual reality (e.g., Google Cardboard, Oculus, HTC VIVE, Merge Cube, Microsoft HoloLens, etc.; Dede, 2009; Alves Fernandes, 2016; Linowes, 2020; Madden et al., 2020).

Digital Game-Based Learning (DGBL): combines the engagement and entertainment elements of play and digital games with educational content, making learning a process of interaction, not passive absorption or drill and practice (Prensky, 2007).

Edutainment: games which typically employ drill and practice methods, aligned with instructor-centered methods of teaching (Bruckman, 1999; Groff, 2018).

Extended Reality (XR): immersive technology which envelopes players in a 3D environment (ICRC, 2018); “a field that comprises virtual reality, augmented reality, and mixed reality” (ICRC, 2018, p. 1).

Gamification: “using ‘elements’ derived from video-game design, which are then deployed in a variety of contexts” (Perrotta et al., 2013, p. ii).

Immersive Digital Games: absorb the entire focus of the player by creating authentic environments (Gard, 2010; Stuart, 2010); includes augmented reality and virtual reality (JFFLabs, 2020).

Immersive Education (Immersive Learning): “participants [feel] a sense of ‘being there’ even when attending a class or training session in person isn’t possible, practical, or desirable” (Immersive Education Initiative as cited in Gardner & Elliot, 2014, p. 2).

Leaderboards: track the highest scores achieved in a given game, challenging players to achieve higher rankings and inspiring continued play to achieve or maintain a high ranking (de Byl, 2013).

Levels: represent the completion of a set of challenges in the game world and serve as a status symbol for players (de Byl, 2013).

Massively Multiplayer Online Role-Playing Game (MMORPG): digital game connecting players from around the globe using a virtual world (Kuss et al., 2012); players adopt avatars (alternate personalities) and interact with each other (Kuss et al., 2012);

encourage problem solving, creative thinking (Dickey, 2006a; Young et al., 2006), and collaboration (Dickey, 2006a).

Mixed Reality (MR): “interaction with and manipulation of both the physical and virtual environment”; “real and the virtual are intertwined” (ICRC, 2018, p. 2).

Multimodal: a form of literacy which includes words, images, sounds, music, and movement; the various combinations of these modes can communicate more than any of them do on their own (Gee, 2003).

Multi-User Dungeon (MUD): text-based electronic game (Indvik, 2012); offers a shared virtual experience (McCormick, 2013); a precursor to the MMORPG (Indvik, 2012)

Points: rewards earned while playing a game; designed to motivate players (de Byl, 2013).

Quests: mini-challenges which make up the larger game journey, providing the player with rewards upon completion (de Byl, 2013).

Serious Games: involve simulated environments reflective of real-world settings (de Byl, 2013; Zyda, 2005); provide opportunities to train, practice, and try out solutions (Karagiorgas & Niemann, 2017) in authentic, risk-free environments (Katsaliaki & Mustafee, 2015); provide access to scenarios which are too costly, complex, or dangerous to deliver in a real-world classroom (Shaffer, 2006).

Situated Learning Theory: theory asserting knowledge is constructed in communities of practice, by the learner, as they interact with their environment (Clancey, 1995; Lave & Wagner, 1991).

Video Arcade: businesses which housed stand-alone, pay-as-you-play, video games; popular throughout the 1970s (June, 2013).

Virtual Reality (VR): deeply immersive experience for players; uses headsets to place players in realistic, simulated, 3D environments (Alves Fernandes, 2016; Madden et al., 2020).

Summary

The quantitative study is arranged into five chapters: (1) Introduction of the Study, (2) Review of the Literature, (3) Methodology, (4) Results, and (5) Discussion, Conclusions, and Recommendations.

Chapter 1 consists of the introduction, statement of the problem, the purpose of the study, the research questions which guided the study, and the definition of terms.

Chapter 2 presents a brief history of games, the evolution of digital games, outlines five types of games used in education, presents the benefits and barriers to digital game usage in schools, and discusses teacher training and professional development related to digital game-based learning.

Chapter 3 provides the details of the quantitative study including methodology, participants, human subject approval, instrument used for data collection and analysis, research design, procedures, and a timeline for the study.

Chapter 4 delivers a thorough analysis of the data collected in the survey.

Chapter 5 presents a summary of the findings, conclusions based on the collected data, discussion, and recommendations for professional practice and further research.

Chapter 2: Review of Related Literature

Introduction

Play is a leading element of healthy child development (Ginsburg, 2007; Vygotsky, 1967). The United Nations High Commission for Human Rights deemed play the right of every child (1989). Play provides children with opportunities to develop their imagination (Ginsburg, 2007), express their creativity, and practice the knowledge and skills they are acquiring in the classroom (Rogers & Sharapan, 1994) within a set of rules (Vygotsky, 1967). Play is a significant component of games, and playing a game involves making choices and taking action (Salen & Zimmerman, 2004).

A game is a contest bound by a set of rules (Avedon & Sutton-Smith, 1979; Fullerton et al., 2008; Hogle, 1996; Prensky, 2001; Salen & Zimmerman, 2004), with goals or objectives (Fullerton et al., 2008; Hogle, 1996; McGonigal, 2011; Prensky, 2001), resulting in measurable outcomes (Fullerton et al., 2008; Prensky, 2001; Salen & Zimmerman, 2004). Gee (2003) and Prensky (2007) also included the element of feedback, which provides players with updates on their progress throughout gameplay, relating to the game’s goals or objectives. Digital games are uniquely suited to deliver authentic learning contexts, teach complex thinking skills, fit pedagogical needs, support a variety of learning styles (Schrier, 2014), and encourage collaboration and innovation (Gee & Shaffer, 2010). All of the above skills will be necessary for success in the future workforce (Gee & Shaffer, 2010).

The review of related literature revealed a range of definitions for electronic games; some authors used the term video games (Granic et al., 2014; Hogle, 1996; Nyitray, 2019; Zyda, 2005) and other authors referred to them as digital games (Hennessey et al., 2017; Hogle, 1996; Van

Eck, 2011; Zyda, 2005). Video games were defined as interactive game experiences played on a computer or other electronic device (Hogle, 1996; Nyitray, 2019, Zyda, 2005) in competition with the device, with other people, or with oneself (Gee, 2013; Hogle, 1996). Granic et al. (2014) highlighted the interactive nature of video games, indicating players "cannot passively surrender to a game's storyline" (p. 67). Huizenga et al. (2017) defined digital games as games played with a digital device. Digital games promote systems thinking, and to succeed in a digital game, players must understand the mechanics and the logic of a system (Van Eck, 2011). Stieler-Hunt and Jones (2015) defined digital games as "any game that uses electronic hardware to deliver some or all of the game," and included "video games played on home and handheld consoles, PC [personal computer] games, web-games, mobile phone games…" (pp. 1-2). For this study, the terms video game and digital game were used interchangeably in reference to electronic games played on gaming consoles (e.g., PlayStation, Nintendo, Xbox, etc.), personal computers, portable devices (e.g., iPads, Chromebooks, smartphones, etc.; Stieler-Hunt & Jones, 2015), or immersive learning technologies such as augmented reality or virtual reality (e.g., Google Cardboard, Oculus, HTC VIVE, etc.; Dede, 2009; Alves Fernandes, 2016; Linowes, 2020; Madden et al., 2020).

The review of related literature was divided into four themes. Theme one provides the reader with a history of games and the evolution of digital games. Theme two examines five types of digital games used in education, including edutainment, serious games, commercial off-the-shelf games, massively multiple online role-playing games, and immersive technologies such as augmented, mixed, and virtual realities. Theme three explores the benefits of implementing digital games in education including increased engagement and motivation, opportunities for collaboration, socialization, critical thinking, problem solving, feedback, differentiation, and autonomy, and provides an expanded definition of literacy. Theme four investigates barriers to the implementation of digital games in education, including concerns over video game violence and addiction, as well as a lack of training for teachers aligned to the implementation of digital game-based learning.

History of Games

Early Games

McGonigal (2011) asserted “games have been a fundamental part of human civilization for thousands of years” (p.5), a claim supported by evidence uncovered by archeologists, revealing early games from around the world, spanning the majority of human history (Avedon & Sutton-Smith, 1979). Remnants of ancient board games were found dating back to 3500-3100 B.C. (Bloom, 2018) and dice made of bone were used by ancient Babylonians and Egyptians for gameplay (Koerper & Whitney-Desautels, 1999, p. 74). Versions of the game of chess were found dating as far back as the mid-thirteenth century (Bloom, 2018). Indications of other early games include backgammon, card games, and playing boards (Bloom, 2018). The earliest traces of games played with a ball dated back to 2500 B.C. Egypt, with the precursor to modern-day soccer, the team sport of Shrovetide football, dating back to at least 1500 A.D. (BBC, 2009; Larsen, 2017). According to scholars, early games evolved around religion (Bloom, 2018), skills needed for human survival (Avedon & Sutton-Smith, 1979), and as a form of socialization (Radoff, 2010). As humans evolved, so did the intricacies of their games (Pursell, 2015).

The earliest predecessor to modern-day digital games may be traced to the game of bagatelle, invented in France in 1777 (Pursell, 2015). Bagatelle resembled the game of billiards and used a cue to shoot balls up a sloped surface (Kent, 2001; Pursell, 2015). Bagatelle improved with the introduction of tension springs and glass tops, and by the early 1900s coin-operated versions of bagatelle were found in drug stores and taverns across the United States (Pursell, 2015). With the addition of electricity and lights during the early 1930s and player-controlled flippers in 1947, bagatelle evolved into the modern-day pinball machine (June, 2013; Kent, 2001; Pursell, 2015). Amusement arcades, which housed coin-operated games such as slot machines and pinball machines, emerged during the first half of the 20th Century (June, 2013). The popularity of coin-operated games continued to grow from the 1940s to the 1970s, up to the time digital video games were introduced (June, 2013).

Early Digital Games

During the 1960s, a single computer filled an entire room, and only three universities in the United States (Massachusetts Institute of Technology, Stanford University, and the University of Utah) had computers with monitors (Kent, 2001). The very first video game, *Spacewar*, was created by a group of students from the Massachusetts Institute of Technology, led by Steve Russell, in 1962 (Kent, 2001; Pursell, 2015). During the 1970s, circuit boards and digital displays replaced the electromechanical controls of the 1950s and 1960s (Pursell, 2015). In 1972, Magnavox released the Magnavox Odyssey, the first home game console (Ervin, 2017; Pursell, 2015). Regrettably for Magnavox, the cost of the Magnavox Odyssey, insufficient advertising, and unfortunate timing led to poor sales, and the original home video game console was short-lived (Kent, 2001). However, technological developments in the field of digital games resulted in the evolution of coin-operated, stand-alone video game units (June, 2013).

Inspired by *Spacewar*, University of Utah students Nolan Bushnell and Ted Dabney created the first commercially successful arcade video game, *Computer Space*, released by Nutting Associates in 1971 (June, 2013; Kent, 2001; Kocurek, 2015; Nyitray, 2019; Pursell, 2015). The next year, 1972, Bushnell and Dabney left their jobs at Nutting Associates and founded a new video game company, Atari, which released the classic video arcade game *Pong*, created by Allan Alcorn (Ervin, 2017; June, 2013; Kent, 2001; Nyitray, 2019; Pursell, 2015). Video arcades, businesses that housed stand-alone, pay-as-you-play, video games gained popularity throughout the 1970s (June, 2013). Atari found success with the 1977 release of the Atari 2600 Video Computer System, a home gaming console, beginning a new era of digital games in the home (Kent, 2001).

Digital Games at Home

In 1978, a computer science student at the University of Essex, Richard Bartle, created the first widely used multiplayer computer game, a Multi-User Dungeon (MUD), which offered a shared virtual experience (McCormick, 2013). MUDs were text-based electronic games, lacking images (Indvik, 2012). The 1980 release of *Space Invaders* for the Atari 2600 Video Computer System initiated the practice of selling home versions of video arcade games (Kent, 2001). *Pac-Man*, the most popular video arcade game of all time, arrived in arcades in 1980, followed up by its release on the Atari 2600 home gaming console in 1981 (Kent, 2001). Nintendo, a Japanese game company dating back to 1889, released their first home video game console, the Nintendo Entertainment System (NES), in 1986 (Pursell, 2015; Kent, 2001). The 1980s also saw the release of the Sega home console and the handheld Nintendo Game Boy

(Kent, 2001). Additional home consoles emerged in the 1990s and 2000s, including the Sony PlayStation in 1994 (McCormick, 2013) and the Microsoft Xbox in 2001 (Kent, 2001).

As home internet speeds increased and personal computer hardware evolved, a new genre of games, massively multiplayer online role-playing games (MMORPGs), emerged (Apperley, 2009; Ervin, 2017; Indvik, 2012). The first version of the modern MMORPG emerged during the 1990s (Indvik, 2012). *Neverwinter Nights*, released in 1991, was an evolution of the text-based MUDs of the 1970s and 1980s (Indvik, 2012). *Nights* connected users through the use of personal computers and the internet, but only amassed a meager following, compared to modern MMORPGs, and the game shut down in 1997 with 150,000 registered players (Indvik, 2012). Multiple MMORPGs emerged throughout the late 1990s and 2000s (Indvik, 2012), but the most successful game to date, *World of Warcraft (WoW)*, premiered in 2004; as of August 2019, *WoW* had over 5 million users (Farner, 2019).

The digital game industry continues to grow with advancements in technology and the increasing affordability of home computers and gaming systems (Indvik, 2012). According to Kocurek (2015), the gaming industry has grown immensely:

> Now an entertainment industry so substantial it regularly outperforms Hollywood’s profits, and an arena for competition so fierce as to support an entire professional circuit, video gaming has come of age as an established industry with its own standards, professional organizations, degree programs, and lobbying groups. (p. 3)

Adolescents of the 21st Century spend significant time outside of school alternating between computers, tablets, cell phones, video games, and other electronic devices (Rosen, 2011, p. 14). The Pew Research Center conducted a study of 1,058 parents and 743 teens, ages 13 to

17, in the spring of 2018 (Anderson & Jiang, 2018, p. 11). Results indicated 95% of teens owned or had access to a smartphone, compared to 73% from the previous study conducted in 2014-2015 (Anderson & Jiang, 2018, p. 7). In addition to smartphone access, 88% of teens had access to a personal computer at home (Anderson & Jiang, 2018, p. 7). The Pew study also determined 45% of teens used the internet "almost constantly," compared to 24% from the previous study conducted in 2014-2015 (Anderson & Jiang, 2018, p. 8). Finally, 84% of teens had access to a digital game console at home, with 90% playing video games of some kind, computer, console, or smartphone (Anderson & Jiang, 2018, p. 9).

As of 2020, the Entertainment Software Association (ESA) estimated 214.4 million Americans played video games, with approximately 70% of children under the age of 18 playing video games regularly (ESA, 2020). In their *2020 Year in Review: Digital Games and Interactive Media*, SuperData, a Nielsen Company, reported earnings of $139.9 billion, a 12% year-over-year growth, by the games and interactive media industry (SuperData, 2021, p. 7). Of the $139.9 billion in revenue earned in 2020, $73.8 billion was spent on mobile gaming, $33.1 billion on personal computer gaming, $19.7 billion on console gaming, and $6.7 billion was attributed to extended reality (p. 7). SuperData's *2020 Year in Review* report attributed a portion of the industry's growth to the COVID-19 pandemic (SuperData, 2021). However, the increase to the digital gaming market is not unique to the COVID-19 pandemic, as indicated by SuperData's *2019 Year in Review: Digital Games and Interactive Media*, in which the games and interactive media industry earned $120.1 billion, an increase of 4% from the previous year (2020, p. 8). SuperData's 2020 Year in Review reported earnings of $589 million for virtual reality games, "as standalone headsets became the device of choice for most users" (SuperData, 2021, p. 20).

Additionally, augmented reality and virtual reality markets are expected to increase between 2018 and 2022, with virtual reality hardware and software usages increasing 587%, from $800 million in 2018 to $5.5 billion by 2023 (JFFLabs, 2020, pp. 10-12).

Digital gaming has become a significant part of modern-day American culture, resulting in a considerable impact on how children spend time outside of school (Chmiel, 2015; Kafai, 2006). The ability of video games to engage and motivate children has prompted growing discussion about their use in education (Kafai, 2006), with experts in the field of education seeking to understand the implications of digital gaming for the future of education (Chmiel, 2015).

Digital Games in Education

Vygotsky's (1967) assertion that play was essential to the development of young children has been widely accepted. However, the banking model of education, used extensively in schools in the United States, places students in the role of uninvolved recipients of information, focusing on drill and practice rather than encouraging student inquiry (Crocco, 2011; Freire, 2005). In education, productivity is deemed vital and student engagement is often discarded in favor of standardized testing (Merkel & Sanford, 2011, p. 399). The conventional perspective of schooling, that students should work hard and strive for the correct answers, has persisted, as evidenced by an increased focus on testing and assessment (Merkel & Sanford, 2011, p. 397). The traditional model of schooling was designed with little consideration for fostering a child's creativity (Freire, 2005), and learning in schools still leans towards a teacher-centered approach (Shute, 2007; Shute & Ke, 2012).

Increasing technological advancements, lower costs, and growing accessibility have driven children's preferences and expectations to more interactive and fast-paced learning (Kirriemuir, 2004), a stark contrast to the conventional style of education, in which students typically spend long periods sitting passively (Rosen, 2011, p. 14). The long-used factory model or banking model of education is focused on rote memorization (Crocco, 2011; Dickey, 2006b; Freire, 2005) and is insufficient to prepare children with the higher-order thinking and problem-solving skills necessary for the swiftly-evolving, technology-rich world awaiting them in the workplace (Burke, 2010; Gee, 2003; Ke, 2009). Future graduates will need preparation for working environments and positions which may not exist yet (Malykhina, 2014; Robinson, 2006), which will require the ability to swiftly learn and adapt on the job (Gee et al., 1996). Digital games are well-suited for use in education due to their potential to provide authentic (Gee & Shaffer, 2010; Schrier, 2014), student-centered learning environments (Q2L, 2020), while encouraging collaboration, innovation, and creative thinking (Gee & Shaffer, 2010).

In 1971, three student teachers from Carlton College in Minnesota, Don Rawitsch, Bill Heinemann, and Paul Dillenberger, developed the original version of the educational digital game *The Oregon Trail* (Bouchard, 2017; Coventry, 2007; Rawitsch et al., 2019). *The Oregon Trail* provided players with a simulation of 19th-century pioneer life (Rawitsch et al., 2019). The objective of the game was to survive a trip by covered wagon, plagued by misfortunes and hardships, from Missouri to Oregon (Rawitsch et al., 2019). By 1974 the Minnesota Educational Computing Consortium (MECC) had formed, with support from the Minnesota legislature, its mission was to develop a state-wide educational computing plan (Bouchard, 2017; Coventry, 2007; Rawitsch et al., 2019). During the same year, the MECC released the original, text-only, version of *The Oregon Trail* to all Minnesota schools (Bouchard, 2017; Coventry, 2007; Rawitsch et al., 2019). *The Oregon Trail* was one of the first digital games used in education, and by the end of the 1970s, the MECC began purchasing discounted Apple II computers and providing them to Minnesota schools at cost, including a copy of *The Oregon Trail* with each computer it sold (Bouchard, 2017; Coventry, 2007; Rawitsch et al., 2019). The MECC restructured in 1984, becoming a public corporation owned by the State of Minnesota, and decided to update several antiquated digital games, including *The Oregon Trail* (Bouchard, 2017; Coventry, 2007). A reimagined version of the game, redesigned by R. Phillip Bouchard, included images and was released in 1985 (Bouchard, 2017; Coventry, 2007). The new version was sold to schools across the country and Minnesota schools were allowed to purchase the game at a significantly discounted price (Bouchard, 2017; Coventry, 2007).

Throughout the 1980s, as video and computer games became increasingly popular, more educators began considering possible applications in education (McCormick, 2013). One of the most popular and successful games, *Where in the World is Carmen San Diego?*, was released for the Apple II computer in the summer of 1985 (Craddock, 2017). The game placed users in the role of a detective searching for an elusive villain, Carmen (Craddock, 2017). The game required players to log in and then tracked their progress, referring to them by name, as players answered questions and solved clues (Craddock, 2017). *Carmen* was intended for exploration and was not originally marketed as an educational game, but teachers embraced the game and its use in schools quickly grew (Craddock, 2017). According to Craddock (2017), the enjoyment *Carmen* provided was a result of its design, which encouraged players to continue playing by rewarding them at the right moments. The game sold more than 4 million copies by 1995, with multiple spin-off products, including a television game show for children (Atwood, 1995, p. 91).

The digital games market continued to grow, and in 1995, thanks in part to games like *Carmen*, the Software Publishers Association reported 66% of people with home computers used educational software, primarily educational software designed for children (Atwood, 1995). Recognizing the impact of critical thinking and problem solving on children's social and intellectual development, Philips Media became a proponent and producer of edutainment, combining entertainment for children and the educational content desired by parents (Atwood, 1995). Disney Interactive also created an edutainment and multimedia division, which developed interactive educational games using familiar cartoon characters (Atwood, 1995).

Monem (2015) asserted, "the way adolescents receive information and acquire new skills has been transformed by digital technology" (p. 454). Maintaining the attention of children born between 1995-2012, known as Generation Z, and developing their higher-order thinking skills will require the use of interactive technologies, such as digital games (Montiel, et al., 2020; Shatto & Erwin, 2016; Swanzen, 2018). The theory of learning in video games aligns with the modern, technology-rich world today's children live in, more so than many of the traditional practices currently employed by schools (Gee, 2003). According to Gershenfeld, co-founder and president of digital game publisher E-Line Media, "digital literacy and understanding how systems (computer and otherwise) work will become increasingly important in a world where many of today's students will pursue jobs that do not currently exist" (Malykhina, 2014, para. 9). However, despite the apparent preferences of children, schools have been slow to incorporate new technologies and methods such as educational digital games (Burke, 2010; Gee, 2003; Montiel et al., 2020).

Educational technology advocates have encouraged the use of technology to enhance content and to help students make connections but have discouraged using technology merely for the sake of using technology (Ke, 2009; Rosen, 2011). Proponents have encouraged the classroom use of digital games because of their ability to incorporate play and to provide simulated environments for learning and assessment (Ke, 2009; McClarty et al., 2012). Game-based learning provides opportunities for interactive learning, and student collaboration in an environment where failure is seen as an opportunity to learn (Q2L, 2020).

Educational philosopher John Dewey, a critic of rote memorization, contended schools should promote social and moral development in children, for the betterment of society (Palmer, 2001). Dewey promoted an experiential learning model which asserted optimal learning occurred as a process, where ideas were formed and re-formed through experience (Beard, 2018; Kolb, 2015; Rich & Reeves, 2016). The experiential learning model aligns with the constructivist learning theory which maintains learners construct their knowledge from the world around them, using inquiry-based methods situated in authentic experiences (Cox, 2018; Hmelo-Silver, 2004; Mughal & Zafar 2011; Otting & Zwaal, 2007; Plass et al., 2016; Rich & Reeves, 2006; UCD, n.d.). The role of the teacher in a constructivist classroom is less focused on lecturing and more on guiding students towards learning (Stapleton & Stefaniak, 2019). Digital games enable learners to build on top of existing knowledge as they advance through the game after mastering the previous skills: an approach known as scaffolding (Bickhard, 1992; Egenfeldt-Nielsen, 2005). Scaffolding requires ongoing evaluation of a learner's progress with just-in-time support structured according to their needs, a task for which digital games are well-suited (Plass et al., 2016). Effective digital games actively involve players in problem-solving activities in an attempt to meet designated goals (Shute & Ke, 2012). The ability of digital games to provide authentic environments, in which interactive problem solving occurs, aligns with the constructivist concept of situated learning (Gee, 2003; Shute & Ke, 2012). Situated learning theory asserts knowledge is constructed in communities of practice, by the learner, as they interact with their environment (Clancy, 1995; Lave & Wagner, 1991).

In 2009 New York City opened Quest to Learn™ (Q2L), a non-charter public school for grades 6-12 with an innovative game-based learning pedagogy (Corbett, 2010; Karagiorgas & Niemann, 2017; Patton, 2013). Katie Salen, a former professor of media design at Parsons, the New York School of Design, co-founded Q2L, working with the New York City-based non-profit Institute of Play to create a new model for teaching and learning for students in grades 6-12 (Salen Tekinbaş, 2020). Q2L was designed around the concept of digital games' significance to the lives of today's children and also, increasingly, as games' speed and capacities grow, as potentially powerful tools for intellectual exploration (Corbett, 2010).

The Q2L mission involves the creation of a learning environment to promote complex problem solving and engagement (Q2L, 2020). According to their website, Q2L follows seven principles of digital game-based learning: (a) everyone participates, contributing their expertise; (b) challenges are on-going and require the use of problem-solving skills; (c) learning is dynamic and experimental; (d) feedback is continuous and instantaneous; (e) failure is seen as a chance to learn, to try again; (f) everything is interrelated, knowledge sharing and collaboration are encouraged; and (g) a student-centered approach engages learners, fostering play, inquiry, and creativity (Q2L, 2020). Digital game-based learning (DGBL) combines the engagement and entertainment elements of play and digital games with educational content, making learning a process of interaction, not passive absorption or drill and practice (Prensky, 2007).

Types of Digital Games

Amidst a wide variety of digital game genres, this literature review grouped five prevailing types of digital games: edutainment, serious games, commercial off-the-shelf games (COTS), massively multiplayer online role-playing games (MMORPGs; Atwood, 1995; de Byl, 2013; Dickey, 2006a; Karagiorgas & Niemann, 2017; Reimer, 2013; Squire & Jenkins, 2003; Wouters et al., 2013), and immersive technologies such as augmented reality (AR) and virtual reality (VR; Dede, 2009; Alves Fernandes, 2016; Kwon, 2019; Linowes, 2020; Lu & Liu, 2015; Madden et al., 2020).

In addition to the terms edutainment, serious games, COTS games, MMORPGs, AR, and VR, the term gamification appear repeatedly during the review of the related literature (Chou, 2017; Hamari, et al., 2014; Kapp, 2014; Landers, 2015; Wouters et al., 2013). The term gamification refers to breaking games down into their components and applying those elements to real-life (McCormick, 2013). Gamification was also defined as the use of game-like features, such as badges, points, and levels, to engage, motivate, and promote learning (de Byl, 2013; Kapp, 2014; Perrotta et al., 2013). In a review of 24 empirical studies, Hamari et al. (2014), sought to answer the question: “Does gamification work?” The authors found evidence suggesting gamification was effective, though the context being gamified, and qualities of the users may affect the outcomes. According to Kapp (2014), the most effective features of gamification were not badges and points, but rather “elements of story, challenge, and continual feedback as well as a high level of interactivity” (p. 52).

Edutainment

An early proponent for the merging of education and entertainment was Professor Gerald S. Lesser, of the Harvard Graduate School of Education (Yu, 2010). Professor Lesser, a child development researcher, was instrumental in the creation of the educational children’s television show *Sesame Street*; he also created the curriculum for the show (Reimer, 2013; Harvard News Editor, 2010; Yu, 2010). Lesser (1972) discussed the competition between entertainment and education, “we always have regarded entertainment and education as competing for a child’s attention” (p. 243). In bringing researchers and educators together to create *Sesame Street*, Lesser believed television could be used as an educational tool (Harvard News Editor, 2010; Lesser, 1972), contributing positively to children’s social behavior and competence (Reimer, 2013). As one of the first forms of edutainment, *Sesame Street* provided “a supplementary educational experience to help prepare children for school by stimulating their appetite for learning” (Lesser, 1972, p. 233). A 1994 study, conducted by Huston et al., determined high school students who consistently watched *Sesame Street* as young children had “better grades in high school,” “read more books for pleasure,” and “expressed less aggressive attitudes” than other students their age (as cited in Reimer, 2013, pp. 2-3). In the past, children spent hours watching television; now, digital games, which marry the vibrant, attractive images of a television with an interactive user interface (Greenfield, 2014), occupy a large portion of children's free time (Anderson & Jiang, 2018). Edutainment was seen as a way in which to promote learning processes both in and out of schools using multimedia applications (Corona et al., 2013, p. 12). In 1995, Phillips Media’s home and family entertainment division used the term edutainment to promote their products and Disney Interactive created an edutainment and multimedia division (Atwood, 1995).

Detractors of edutainment digital games have expressed concern over the drill and practice methods they employ, which align with instructor-centered methods of teaching (Bruckman, 1999; Groff, 2018). Edutainment games add elements of fun to learning in an attempt to entice students, which Bruckman (1999) referred to as “chocolate-dipped broccoli” (p. 75). Additionally, edutainment games have been compared with bad lectures (Squire & Jenkins, 2003) and criticized for the questionable game experiences they provide (Engefeldt-Nielsen, 2005). With the evolution of learning theories and advancements in technology, educational games progressed, evolving into a new genre of games, serious games, which include elements of critical thinking and problem-solving (Groff, 2018; McClarty et al., 2012).

Serious Games

Serious games are designed to engage players (de Byl, 2013; Kapp, 2014) and require the use of problem-solving skills (Kapp, 2014; Karagiorgas & Niemann, 2017; Ziechermann & Cunningham, 2011). They use game-like elements such as points, levels, and game-based thinking, to educate or train (de Byl, 2013; Kapp, 2014; Karagiorgas & Niemann, 2017; Landers, 2015; Ziechermann & Cunningham, 2011).

Serious games involve simulated environments reflective of real-world settings, a feature useful in a variety of fields including defense, healthcare, research, and production (de Byl, 2013; Zyda, 2005). They deliver opportunities to train, practice, and try out solutions (Karagiorgas & Niemann, 2017) in authentic, risk-free environments (Katsaliaki & Mustafee, 2015). Human beings understand best when they’re allowed to explore, test hypotheses, fail, and learn (Gee, 2003; Gee, 2013). Serious games also provide access to scenarios otherwise too costly, complex, or dangerous to deliver in a real-world classroom (Shaffer, 2006). Whereas serious games (e.g., *The Oregon Trail*) are designed for use in education, games created for entertainment purposes (e.g., *Where in the World is Carmen San Diego?*) have also been used in education (Van Eck, 2009; Wouters, et al., 2013).

Commercial Off-The-Shelf (COTS) Games

COTS games are designed with entertainment, not education, in mind, and as such, they may be more engaging and motivating than games designed specifically for educational use (Van Eck, 2009; Wouters et al., 2013). According to Becker (2007), not all commercial games are appropriate for the classroom, just as not all books or movies may be appropriate for the classroom. Becker (2007) highlighted the importance for teachers to understand both the values and the issues surrounding digital games in order to make informed decisions regarding their use in the classroom. Effective use of COTS games in an educational setting requires teachers willing and able to develop specialized lesson plans designed to benefit from game features (Van Eck, 2009). Additionally, successful implementation of COTS games requires teachers who “understand how games embed instructional strategies, objectives, assessments, and the other instructional elements that all effective instruction uses” (Van Eck, 2009, p. 3).

Kim et al. (2009) discussed the benefits and challenges of using games designed for educational purposes (serious games) and of COTS games used in educational settings. The authors highlighted concerns around serious games, including the time and cost required to develop them, as well as their potential inability to engage students. Kim et al. (2009) also highlighted possible challenges for COTS games, stating their focus on entertainment, rather than education, might create difficulties in aligning COTS games to the curriculum. The authors highlighted the importance of teachers employing instructional strategies designed to utilize the game aspects, especially when using COTS games. A subset of COTS games, MMORPGs, connects a large number of players through the Internet, providing unique opportunities for collaboration and a sense of shared community (Monem, 2015).

Massively Multiplayer Online Role-Playing Game (MMORPG)

Kuss et al. (2012) defined MMORPGs as games "in which numerous players around the globe inhabit a single virtual realm simultaneously, adopt alternative personas and interact with one another in multiple ways" (p. 2). MMORPGs have also been associated with increased motivation (Dickey, 2006a; Karagiorgas & Niemann, 2017) and encourage strategizing, problem-solving, and creative thinking (Dickey, 2006a; Young et al., 2006). MMORPGs allow players to immerse themselves in virtual three-dimensional worlds (Karagiorgas & Niemann, 2017, p. 507), which in turn allows them to freely experiment and express themselves (Monem, 2015, p. 455). These virtual worlds persist even after players log-off, meaning the game continues in real-time (Dickey, 2006a; Wagner & Ip, 2009).

Smith (2017) contended the potential for interactivity in MMORPGs provided additional opportunities for players to learn from the game as well as from fellow players. Smith (2017) and Dickey (2006a) highlighted the flexibility afforded by MMORPGs. Key benefits of MMORPGs also include the opportunities for collaboration and character development, allowing for individualization (Dickey, 2006a). MMORPGs may also be used to develop critical-thinking skills and, when set in realistic virtual worlds, may be used to facilitate solutions to real-world problems (Karagiorgas & Niemann, 2017, p. 515). MMOPRGs deliver clear goals (in the form of quests) and immediate feedback, allowing players to select challenges suited to their individual skill levels (Karagiorgas & Niemann, 2017).

MMORPGs provide an immersive environment for players (Karagiorgas & Niemann, 2017). The Immersive Education Institute defined immersive education as providing “participants [with] a sense of ‘being there’ even when attending a class or training session in person isn’t possible, practical, or desirable” (Immersive Education Initiative as cited in Gardner & Elliot, 2014, p. 2). Augmented reality and virtual reality games provide richer, more immersive environments than MMORPGs (Madden et al., 2020).

Extended Reality

The term extended reality (XR) is used to describe a field of immersive technologies which include augmented reality (AR), mixed reality (MR), and virtual reality VR games (ICRC, 2018). XR games deliver deeply immersive experiences for learners by placing them within rich, simulated environments (Madden et al., 2020). AR games provide a combination of real-world and virtual settings (Dede, 2009), overlaying digital items onto the real world, creating a sense of immersion (Lu & Liu, 2015). MR games weave together real and virtual elements, “the virtual information is overlaid as well as anchored in the real world; virtual graphics can interact with real world structures” (ICRC, 2018, p. 2). VR games use headsets to place players in realistic, simulated, 3D environments (Alves Fernandes, 2016; Madden et al., 2020). The use of head-mounted displays increases levels of “vividness, interactivity, and presence” (Kwon, 2019, p. 104). However, simulator sickness, similar to motion sickness, has been reported during the use of VR games (Kwon, 2019). The use of head-mounted displays has been significantly related to instances of simulator sickness, though more authentic virtual reality has provided relief from simulator sickness (Kwon, 2019). Further advancements in technology have enabled deeper physical interactions, including the development of digital gloves and similar haptic devices, enhancing users' ability to interact with virtual objects (Kwon, 2019). Authentic virtual reality provides players with deeply realistic experiences and rich interactivity, closely resembling real-world experiences (Kwon, 2019).

Benefits to Implementation of Digital Games in Education

The Project Tomorrow® (2016) annual research project was designed to gather stakeholder input related to K-12 education to assist schools and communities in better supporting the needs of today's learners. In a fall 2015 study, Project Tomorrow® shared the views of 4,536 administrators, 38,613 teachers, and 415,686 students (p. 2). A majority of administrators (82%) indicated their districts had "implemented a variety of digital content and online resources in their classrooms" (p. 4). Additionally, 40% of administrators reported the inclusion of digital games for learning in their classrooms and 84% of administrators indicated "effective use of technology within instruction is important to student success" (p. 4).

Support for digital games in education has been based on their ability to engage (Chmiel, 2015; de Byl, 2013; Gee, 2013; Groff et al., 2010; Hogle, 1996; Kim et al., 2009; Rosen, 2011) and motivate learners (Egenfeldt-Nielsen, 2006; Karagiorgas & Niemann, 2017; Ke, 2008; Kim et al., 2009; Tsai et al., 2015). Digital games also offer opportunities for collaboration and social development (Chmiel, 2015; Chou & Tsai, 2007; de Byl, 2013; Gee, 2003; Lu & Liu, 2015; Monem, 2015), while allowing learners to exercise critical-thinking and problem-solving skills (Chuang & Chen, 2009; Hogle, 1996; Karagiorgas & Niemann, 2017; Ke, 2009; Kulman et al., 2014; Lu & Liu, 2015). In addition, digital games provide ongoing, real-time feedback

(McGonigal, 2011; Tsai et al., 2015; Weitze, 2014), opportunities for differentiation (Malykhina, 2014; Salen et al., 2011; Weitze, 2014), and encourage autonomy (De Grove et al., 2012; Egenfeldt-Nielsen, 2006; Merkel & Sanford, 2011) while promoting new forms of literacy (Compaine, 1983; Gee, 2003).

Engagement and Motivation

Digital gaming is recognized as an activity which stimulates intrinsic motivation in players (Hogle, 1996; Tsai et al., 2015). Interest relating to the power of digital games to engage and motivate learners continues to grow as they provide opportunities for learning and application of new knowledge and concepts in meaningful ways (Chmiel, 2015). Learners find greater pleasure when play is involved, indicating knowledge acquired during play is learned with enjoyment and may ease classroom management issues and increase player motivation (Avedon & Sutton-Smith, 1979, p. 315). The enjoyment students experience when engaged with digital games may provide initial motivation, which may then be nurtured to promote a love of learning (Karagiorgas & Niemann, 2017, p. 515). Project Tomorrow's® (2016) annual report surveyed 415,686 students regarding their use of digital tools, including digital games. Results revealed 61% of students played online games during their own time in pursuit of self-directed learning (p. 10).

Game-based learning allows students to experience the world in new ways (Gee, 2013; Groff et al., 2010). In a study of 487 fifth-grade students in Pennsylvania, Ke (2008) found evidence that digital games were more effective than paper and pencil activities in fostering students' motivation to learn. "To put it simply, games are engaging" and digital games merge entertainment and learning (Kim et al., 2009, p. 800).

The challenge for digital game designers is to create games sufficiently exciting to challenging enough to promote continued play without making the game so difficult the player gives up in frustration (Chmiel, 2015; Gee, 2007). Good games are enjoyable, but they are also strenuous work (McGonigal, 2011). According to Gee (2003) "learning should be both frustrating and life enhancing" or as Gee called it "pleasantly frustrating" (p. 3). Ervin (2017) asserted digital gaming provided an escape from the real world, where "most of my inner voices grow quiet" and compared flow found while digital gaming to Zen meditation (p. 151).

Csikszentmihalyi (2008) determined the optimal learning experience occurred when the learner feels a balance between difficulty and ability. Flow theory states the majority of optimal learning occurs when learners participate in goal-oriented activities, bound by rules (Csikszentmihalyi, 2008; Malone & Lepper, 1987). Additionally, achievement of a state of flow requires high levels of concentration (Csikszentmihalyi, 2008; Jong et al., 2019) without crossing into anxiety or fear of failure (Csikszentmihalyi, 2008; Keyes, 2001). Flow is achieved when we triumph over adversity, as it produces a sense of pride (Lazzaro, as cited in Ervin, 2017, p. 150; McGonigal, 2011). "Flow is important both because it makes the present more enjoyable, and because it builds the self-confidence that allows us to develop skills and make significant contributions to humankind" (Csikszenmihalyi, 1990, p. 42). A study completed by Pavlas et al. (2010) confirmed flow was a significant indicator of successful learning and intrinsic motivation. In addition to promoting engagement and motivation, digital games hold the potential to encourage collaboration and socialization (Kapp, 2014; Monem, 2015; Shaffer et al., 2005).

Collaboration and Socialization

Digital games offer opportunities for interaction between multiple players, which influences social interaction (Domínguez et al., 2013). Psychologist Lev Vygotsky approached the constructivist learning theory from a social perspective (Bruckman, 1999; Kritt, 2018; Nino & Evans, 2014; UCD, n.d.). According to the theory of social constructivism, students should be involved in the building of their own learning, constructing and reconstructing knowledge in a collaborative environment (Monem, 2015; Otting & Zwaal, 2017). “Computer networks have the potential to create ‘electronic learning communities,’ places where participants support one another’s learning experiences” (Bruckman, 1999, pp. 77-78). Most notably, Vygotsky established the concept of the Zone of Proximal Development (Chmiel, 2015; Lourenço, 2014; UCD, n.d.). The Zone of Proximal Development is the point at which a learner is able to learn with the assistance of someone else, such as a teacher or peer (Chaiklin, 2003; Chmiel, 2015; UCD, n.d.; Van Eck, 2011).

Results from a survey of 1,000 Taiwanese students ages 15-18, conducted by Chou and Tsai (2007), indicated social interaction was a significant motivator for children who engaged with video games. One particular genre of games, MMORPGs, is especially conducive for collaboration, socialization, and participation in a shared community (Monem, 2015). In a Skype conversation with Ervin (2017), game designer Adam Saltsman stated a significant contribution to the success of MMORPGs like *WoW* was the opportunity for players to interact while completing shared adventures. When players were engaged with a game emotionally, then re-engaged through social interaction, social loops were created (de Byl, 2013). Interactions with other players also occur outside of virtual worlds, in spaces shared by people who share game experiences, a place Gee (2003) referred to as affinity spaces. Digital games encourage collaboration and socialization inside and outside of games, including classroom discussions (Shaffer et al., 2005).

Jean Piaget, a psychologist focused on child development, approached the constructivist learning theory from a cognitive perspective (Bruckman, 1999; Hogle, 1996; Stapleton & Stefaniak, 2019; UCD, n.d.). Piaget asserted children progress through four stages of cognitive development, and a child's ability to learn concepts was restricted to their current cognitive stage (Lourenço, 2014; UCD, n.d.). Piaget recognized social play contributed to child development and learning, but contended the greatest impact came from the child's own actions (Lourenço, 2014). "In the cognitive area, a game provides a complex system of rules along with series of tasks that guide players through a process to master those rules" (Domínguez et al., 2013, p. 381). In addition to socialization and working within a set of rules, digital games may also improve visual attention and reaction times as well as increase processing speeds (Tobias et al., 2014) and critical thinking skills (Dickey, 2006a).

Critical Thinking and Problem Solving

Employment in the workforce of the future will require problem-solving skills (Levy & Murnane, 2004; Shute & Ke, 2012). "By their very nature, video games and digital technologies require flexible thinking as problem-solving strategies change from one level to another" (Kulman et al., 2014, p. 165). Gee (2003) proposed two elements of digital gameplay which contributed to active and critical learning: (a) games which were crafted to encourage and facilitate active and critical learning and thinking and (b) people around the learning (other players and nonplayers) encouraged reflective metatalk, thinking, and actions. Digital games immerse players in realistic virtual worlds, promoting critical-thinking and problem-solving skills in safe, engaging environments (Gard, 2010; Gee, 2003; Linowes, 2020; Madden et al., 2020). A meta-analysis of eighty-nine empirical studies revealed digital games stimulated higher-order thinking skills even more than knowledge acquisition (Ke, 2009). Chuang and Chen (2009) conducted a study of 108 third-grade students in Taiwan, which indicated playing video games helped improve learning, recall, critical-thinking skills, and problem-solving skills.

In a study of 132 ninth-grade students in South Korea, Kim et al. (2009) investigated “the effects of meta-cognitive strategies on problem-solving ability and achievements in game-based learning” (p. 808). The authors ranked three meta-cognitive strategies found in game-based learning by their observed benefits to students; these strategies consisted of self-recording, modeling, and thinking aloud. In the least effective method, self-recording, students selected one concept presented by the teacher and wrote everything they knew about the concept prior to playing the game. In the second most effective method, modeling, students stopped every 10 minutes during gameplay to observe their peers’ gameplay. The most effective method, thinking aloud, involved students talking about their game experiences during breaks, which promoted social problem-solving. Digital games’ ability to develop critical-thinking and problem-solving skills (Gee, 2003; Ke, 2009) is also facilitated by the ongoing feedback and differentiation they provide to players (McGonigal, 2011; Richard, 2014; Salen et al., 2011).

Feedback and Differentiation

According to Tony Mai, a former middle school English Language Arts teacher in New York City, “teachers want to be able to see gains that students are making on a specific skill and be able to link it to a specific question or part of the game” (Schwartz, 2014, para. 7). Mai indicated games with robust data tracking were most likely to achieve teacher buy-in (Schwartz, 2014). Video games generate massive amounts of data on players (Becker & Parker, 2014), and the “variety and intensity of feedback is the most important difference between digital and nondigital games” (McGonigal, 2011, p. 23). Feedback is an integral part of digital games and should be both relevant and instantaneous (Gee, 2003; Malykhina, 2014; Weitze, 2014), providing players with ongoing updates on their progress (McGonigal, 2011).

Tsai et al. (2015) conducted a 2 x 2 factor experimental study with 109 ninth-grade students from a Taiwanese junior high school. The researchers evaluated the effects of gaming modes and feedback on knowledge acquisition. The authors observed two gaming modes, single-player online games and multi-player online games, and examined two forms of feedback, immediate elaborate feedback and no immediate elaborate feedback. The results indicated different gaming modes (single-player and multiplayer) had no effect on students’ knowledge acquisition (Tsai et al., 2015). However, the feedback type (immediate elaborate feedback or no immediate elaborate feedback) impacted knowledge acquisition, with immediate elaborate feedback contributing significantly to game-based learning. The inclusion of feedback messages did not influence participant enjoyment of the game experience, suggesting immediate elaborate feedback should be provided without fear of diminished player enjoyment (Tsai et al., 2015).

The extensive data provided by digital games allows educators to assess students and meet their current needs through scaffolding (Weitze, 2014) and differentiation (Salen et al., 2011; Weitze, 2014). Malykhina (2014) connected digital games’ responsiveness to their capacity to adapt and meet students’ needs, which may be especially helpful for struggling students. Digital games offer immediate feedback, provide ongoing support, adjust difficulty levels to meet players’ skill levels (Richard, 2014), and offer real-time scaffolding (Weitze, 2014) and differentiation (Salen et al., 2011; Weitze, 2014). Digital games assist in tailoring learning to meet the needs of students (Richard, 2014), enable players to progress through the game at the appropriate pace for their level (Dickey, 2006a), and allow players to take control of their learning (De Grove et al., 2012, p. 2023).

Autonomy

The ability to take risks in a safe environment, without fear of failure, helps secure students’ sense of autonomy (Egenfeldt-Nielsen, 2005; Mishra & Foster, 2007). Plass et al. (2016) described the lowered consequences in digital games as the “ability to fail gracefully” (p. 261). In their book *A Simpler Way*, Wheatley and Kellner-Rogers (1996) asked the question: “if we are free to play, to experiment and discover, if we are free to fail, what might we create?” (Wheatley & Kellner-Rogers, 1996, as cited in Merkel & Sanford, 2011, p. 399). Digital games provide players with opportunities to take the initiative and set goals (Lu & Liu, 2015). In addition to increased autonomy (Egenfedlt-Nielsen, 2005; Mishra & Foster, 2007), digital games provide opportunities to explore new forms of literacy (Gee, 2003).

Multimodal Literacy

Traditionally, the term literacy referred to the ability to read and write (Gee, 2003), but Compaine (1983) noted the ever-evolving nature of literacy, citing its dynamic nature. Gee (2003) suggested reading and writing skills would be insufficient to ensure success in the workforce of the future. More recent definitions of literacy have incorporated multiple modes of meaning including written and spoken words, images, sounds, music, movement, and gestures

(Gee, 2003; Mills & Unsworth, 2017). Multimodal literacy “refers to the study of language that combines two or more modes of meaning” (Mills & Unsworth, 2017, para. 1).

Digital games provide multimedia experiences, and multimedia information affects cognitive load or the amount of information a person can process (Chang et al., 2017). Digital games may contain elements which affect extraneous cognitive load, meaning digital games may provide too much information for learners, overloading their cognitive capacity (Mayer, 2014; Sweller, 2010). “An individual’s operational memory system can handle only a limited amount of information at once. If the amount exceeds the learner’s operational memory load, learning will be hindered” (Liao et al., 2019, p. 45). In addition to potentially overloading a learner’s cognitive load, multiple barriers were identified to the implementation of digital game-based learning in the classroom.

Barriers to Implementation of Digital Games in Education

Despite the potential benefits outlined above, and the shift in adolescents’ acquisition of information and new skills (Monem, 2015), educators face multiple barriers to the successful implementation of digital games and immersive technologies in the classroom (Becker, 2007; Cowan, 2008; Darling-Hammond et al., 2017; Groff et al., 2010; Groff et al., 2016; Joyce et al., 2009; Li et al, 2015). Numerous barriers to the successful implementation of digital games in the classroom have been reported (Becker, 2007; Cowan, 2008; Groff et al., 2010; Groff et al., 2016; Joyce et al., 2009). Not all teachers are persuaded by the potential benefits of using digital games (Huizenga et al., 2017). Teachers may have difficulty finding appropriate educational games (Baek, 2008; Joyce et al., 2009), struggle with short lesson times (Egenfeldt-Nielsen, 2006; Lu & Liu, 2015), and have issues restructuring their traditional teaching practices to integrate digital game-based learning (Baek, 2008). Other reported barriers to implementation include a lack of resources, declining budgets (Becker, 2007; Egenfeldt-Nielsen, 2006; Joyce et al., 2009), pressures to perform well on standardized tests (Pressey, 2013), a lack of experience using digital games in educational settings (Groff et al., 2016), and inadequate tech support (An, 2018; Cowan, 2008; Groff, 2018; Groff et al., 2010; Joyce et al., 2009; Meredith, 2016; Takeuchi & Vaala, 2014).

A 2010 survey of school leaders in 19 Scottish schools found “school leaders face a number of barriers in encouraging game-based learning in their schools which include resourcing issues and teachers’ initial reticence to get involved” (Groff et al., 2010, p. 6). Baek (2008) surveyed 35 teachers in Korea with issues finding effective digital games and successfully integrating them into their day-to-day routine. A comparative analysis of five national teacher surveys marked “time constraints and an overemphasis on testing and reform as significant barriers to incorporating technology into the classroom” (Pressey, 2013, p. 16). Additionally, the Joan Ganz Cooney Center at Sesame Workshop surveyed 505 American teachers in grades K-8, who considered cost as the greatest barrier to using video games in the classroom at 50%, closely followed by access to technology at 46%, with an emphasis on standardized testing at 38% (Millstone, 2012). In some cases, digital games hold a negative connotation (Groff et al., 2016), meaning teachers, parents, and administrators need to be convinced of their value (SIIA, 2009).

The review of related literature revealed three significant barriers to the implementation of digital games in education, including concerns over violence in video games, worries about digital gaming addiction, and insufficient training and professional development for teachers

(An, 2018; Cowan, 2008; Groff, 2018; Groff et al., 2010; Joyce et al., 2009; Meredith, 2016; Project Tomorrow®, 2016; Takeuchi & Vaala, 2014).

Violence

Concerns regarding the presence of violence in video games began with the 1976 video game *Death Race*, in which “players ran over stick figures that were supposed to be skeletons escaping from a graveyard” (Kent, 2001, pp. 90-91). In 1993, Senators Joe Lieberman and Herbert Kohl led a Congressional hearing to address video game violence (Gershenfeld, 2014; Harris, 2014). The intent of the hearing was to introduce legislation requiring the video game industry to implement a mandatory, consistent rating system (CSPAN, 1993). In 1994, the Entertainment Software Rating Board (ESRB) was created by the Interactive Digital Software Association, now the Entertainment Software Association (ESRB, n.d.). Today, the ESRB provides a four-part rating guide consisting of: (a) rating categories; (b) descriptions of content; (c) interactive elements such as the ability of players to interact with each other; and (d) rating summaries (ESRB, n.d.).

Studies conducted regarding the potential impacts of video game violence have produced mixed results (Chang & Bushman, 2019; Ferguson & Wang, 2019; Lobel et al., 2017; Shao & Wang, 2019). Chang and Bushman (2019) conducted a randomized clinical trial utilizing 220 children ages 8 to 12 years randomly selected to play a digital game containing either gun violence, sword violence, or no violence. The results revealed exposure to violent video games containing guns increased children’s interest in firearms, including the chances they would pick up a real gun (p. 10).

Shao and Wang (2019) conducted a study involving 648 Chinese students ages 12 to 19 years, 339 boys and 309 girls (p. 3). The authors surveyed students in cities, towns, and in the countryside to determine: (a) the video games played; (b) the children's aggressive tendencies; (c) the children's family and home environment; and (d) their normative beliefs about aggression (p. 3). Results of the study indicated a positive relation between video games and adolescent aggression, though positive family environments and normative beliefs about aggression had a calming effect on adolescent aggression associated with violent video games (p. 7).

Other researchers, however, found "the effect size of video-game play on aggression is smaller than the effect size for television" (Gee, 2003, p. 11). Ferguson & Wang (2019) conducted a study of 3,034 young people in Singapore, 72.8% were male, with a mean age of 13.12 years (p. 1442). The study participants were surveyed three times a year over two years and exposure to aggressive video games was not linked to aggressive behavior (p. 1447). Lobel et al. (2017) examined 194 children ages 7-11, who completed a self-evaluation at the beginning and the end of one year. Parents also completed survey responses about their children as a part of the study. The researchers concluded a lack of negative associations aligned to the use of violent video games with aggressive behavior or with most domains of children's psychosocial development. The contrasting results relating to the possible effects of aggressive digital games have led some to question whether it is a matter of correlation or causation (Tobias et al., 2014). In addition to concerns over violence, "as with other intrinsically enjoyable behaviours, game playing can become excessive if not regulated" (Boyle et al., 2011, p. 70).

Addiction

Pac-Man, an early arcade game, provided clear goals and immediate feedback as players proceeded through increasingly difficult levels, leading to an immersive experience some people considered addictive (Bowman Jr., 1982). As Ervin (2017) emphasized, video game design companies strive to make games as addictive as possible. When asked about the inspiration behind some of Nintendo's most iconic video games, including *Mario Bros.*, *Donkey Kong*, and *The Legend of Zelda*, video game designer Shigeru Miyamoto admitted that early on, when the games were coin-operated and located in video game arcades, the goal was for players to keep putting quarters into the machines (as cited in NPR, 2015). As digital gaming evolved, Miyamoto stated, the designers' focus shifted to creating "worlds that people would want to immerse themselves in, the way you immerse yourself in a book or in a movie" (as cited in NPR, 2015, para. 22).

Ervin (2017) provided an example of parents imprisoned for neglecting their children in favor of playing a video game, so much so that their children suffered from malnourishment (p. 156). Additional documented instances included players who died after playing a video game non-stop for an excessive amount of time or after being hit by a car when crossing a road while playing *Pokémon Go* (Nguyen, 2017). Clayton R. Cook, Associate Professor at the University of Minnesota College of Education and Human Development stated: "video game addiction is a real thing that is supported by mounting scientific evidence" (Ervin, personal communication, June 15, 2016). However, some researchers have suggested the tendency for addiction may be a symptom of a wider problem, pre-existing mental or behavioral disorders, highlighting the importance of solid support systems for adolescents (Thorsteinsson & Davey, 2014, p. 16).

In addition to concerns over violence (Chang & Bushman, 2019; Ferguson & Wang, 2019; Lobel et al., 2017; Shao & Wang, 2019) and addiction (Boyle et al., 2011; Ervin, 2017; Thorsteinsson & Davey, 2014), a significant barrier to the implementation of digital games in education lies in a lack of teacher training related to the integration of digital games in the classroom (Becker, 2007; Darling-Hammond et al., 2017).

Teacher Training

A 2009 survey, conducted by The Richard W. Riley College of Education and Leadership at Walden University, resulted in responses from over 1,000 teachers and administrators in grades K-12 (Grunwald Associates LLC, 2010). The survey results indicated a majority (55%) of new teachers did not feel prepared by their teacher preparation program to properly integrate digital technologies into their classrooms (Grunwald Associates LLC, 2010).

The Joan Ganz Cooney Center surveyed 694 American teachers in grades K-8 in the fall of 2013 (Takeuchi & Vaala, 2014). The Cooney Center results revealed 513 (74%) of the 694 respondents used digital games in their classrooms, while 26% never used digital games (Takeuchi & Vaala, 2014, p. 15). Of the 513 game-using teachers, only 8% learned about educational digital game usage in their teacher preparation program, 17% learned about digital games during in-service teacher professional development, and 33% learned about digital games from another teacher, coach, or supervisor (Takeuchi & Vaala, 2014, p. 18). Neither teacher preparation programs nor in-service professional development offerings provided sufficient training to integrate digital games into the classroom (Takeuchi & Vaala, 2014). This finding was supported by Meredith (2016) in a review of literature focused on game-based learning in K-12 teacher professional development. Game-based learning in professional development is an untapped area of research, and “there is an obvious gap in the literature where GBL [game-based learning] in professional development with K-12 teachers is concerned” (Meredith, 2016, p. 500).

In the spring of 2015, Samsung surveyed 1,008 K-12 teachers in the United States (Samsung, 2015). While 90% of teachers believed technology was an important contributor to student success, 60% felt they were not prepared to use technology in the classroom. The majority of teachers (91%) agreed up-to-date training was essential to technology integration, but one in three (32%) were dissatisfied with the technical support they received from their school district (Samsung, 2015). According to the Project Tomorrow® (2016) research report, of the 4,536 administrators surveyed, 57% reported a lack of teacher training related to the integration of digital content within the curriculum was a significant barrier to implementation (p. 5). In 2018, researcher An recommended professional development programs introduce teachers to a range of subject-specific digital games and provide examples of effective integration. Additionally, training should provide teachers with the tools to evaluate digital games’ compatibility and suitability for use in their classrooms (An, 2018; Becker, 2007), using both the evaluation of actual games and reviews provided by other educators (Becker, 2007).

Prensky (2001) labeled the first generation of children born into a world of pervasive technology usage as “digital natives” (p. 1). Individuals born between 1981-2000, labeled Generation Y or Millennials (Swanzen, 2018), were exposed to digital technologies for the majority of their lives, leading to the assumption they would be more capable of implementing digital technologies in the classroom (Lei, 2009; Li et al., 2015; Morris, 2012). However, while Millennials used technology from a young age, they struggled with more complex technologies

(Lei, 2009; Southall, 2012), and research showed they were not prepared to incorporate digital technologies into their teaching practices (Lei, 2009; Morris, 2012). Children born between 1995-2012, known as Generation Z, were also believed to be more technologically savvy than previous generations (Montiel et al., 2020; Shatto & Erwin, 2016; Swanzen, 2018). However, a gap exists between their personal technology skills and the skills needed to effectively integrate technology into their classrooms (Li et al., 2015, p. 1). The effectiveness of teachers' educational technology training plays a significant role in student outcomes when using digital technologies (Darling-Hammond et al., 2017; Rutherford et al., 2017; Stieler-Hunt & Jones, 2019). Recommendations for successful professional development include school districts partnering with universities and other teacher certification programs to provide digital game-based learning training to teachers (Takeuchi & Vaala, 2014, p. 59).

Darling-Hammond et al. (2017) conducted a literature review of 35 studies which examined professional development and student outcomes, outlining seven characteristics of successful professional development. According to Darling-Hammond et al. (2017), successful professional development:

- Is content specific, embedded within the teachers' classroom, and preferably aligned to the school and districts priorities (pp. 5-7)
- Incorporates active learning, employing teachers' own resources, based on their interests and needs, and includes inquiry and reflection (p. 7)
- Supports collaboration, allowing for the exchange of ideas; includes one-on-one interaction, small groups, district-wide, and beyond (p. 9)

- Uses models of effective practice, enabling teachers to ground their learning in real-world settings; includes case reviews, demonstrations, lesson plans, observations, and curriculum materials (p. 11)
- Provides coaching and expert support, often from other teachers; may incorporate content experts (p. 12)
- Offers feedback and reflection, with time built-in to the training (p. 14)
- Is of sustained duration, with multiple sessions, providing the time necessary for implementation, reflection, and further learning (pp. 15-16)

The review of literature highlighted a shift in adolescents’ acquisition of information and new skills and outlined numerous potential benefits of digital game-based learning (Monem, 2015). Research also indicated increased confidence of educators using digital games after receiving professional development aligned to their application in the classroom (An, 2018), and appropriate teacher training and professional development were necessary for successful classroom implementation (Darling-Hammond et al., 2017). However, the review of literature also revealed the lack of P-12 school training and professional development related to digital game-based learning (An, 2018; Groff, 2018; Meredith, 2016; Takeuchi & Vaala, 2014).

Chapter 3: Methodology

Introduction

Chapter three provides details outlining the quantitative study, including research design, instrumentation, participants, human subjects approval, data collection procedures, data analysis, and a timeline for the study.

The purpose of this study was to determine the current professional development practices, related to digital game-based learning, in select Northern Minnesota P-12 schools. This study also identified Northern Minnesota teachers' perceived barriers and benefits to the implementation of digital games and immersive learning in the classroom. Results of this study may provide administrators with insights to trainings, resources, and supports related to digital game-based learning. A review of the literature revealed a lack of educator training, both pre-service teacher preparation and in-service professional development, aligned to the use of educational digital games (An, 2018; Groff, 2018; Meredith, 2016; Takeurchi & Vaala, 2014). This study focused on the professional development of in-service teachers.

Research Questions

The following research questions were used to guide this study:

1. What forms of training and to what extent do select Minnesota teachers in grades P-12 report receiving related to the integration of digital games into their curriculum?
2. What do select Minnesota teachers in grades P-12 report as the benefits of integrating educational digital games into their curriculum?
3. What do select Minnesota teachers in grades P-12 report as barriers to the integration of educational digital games into their curriculum?

4. What do select Minnesota teachers in grades P-12 report as the needed resources, supports, and trainings related to the integration of educational digital games into their curriculum?

Research Design

A quantitative design was selected for use in this study. Quantitative research designs provide larger sampling sizes (Roberts, 2010), permitting the researcher to make generalizations associated with the data collected (Eyisi, 2016). The data were collected in the form of measurable numbers and percentages and processed using analytics, artificial intelligence, and data management package SAS® 9.4 (SAS Institute Inc., n.d.).

The researcher developed a web-based survey, adapted from previous research conducted by Dr. Min Lin Wu (2015). Dr. Wu granted permission to repurpose their survey (see Appendix H). The survey instrument used in this study was designed to provide Minnesota P-12 teachers from select districts an opportunity to offer their quantitative perceptions of digital game-based learning.

This study examined the forms and extent of teachers' training as well as their perceptions regarding the potential benefits and barriers to the implementation of digital game-based learning. The study also examined the training and supports teachers reported were needed to implement digital game-based learning in their classrooms.

Instrumentation

A web-based survey, consisting of 10 questions, was developed by the researcher to serve as the data-gathering instrument for this study (see Appendix G). The instrument questions were adapted from previous research conducted by Dr. Min Lin Wu (2015). Dr. Wu granted permission to repurpose their survey (see Appendix H). The survey instrument was pilot tested in a first-year doctoral cohort.

The survey questions were designed to collect the demographic data of the research participants, as well as data on the perceived benefits and barriers to implementing digital games in education. Additionally, the survey questions were designed to determine the forms and extent of training the participants had already received as well as the training and support they would need to promote the use of digital games to deliver or supplement educational content in their classroom.

Survey instrument questions 1, 2, and 3 were demographics questions used to determine the grade levels, areas of specialization, and years of teaching experience.

Survey question 4 asked participants to select the device(s) they had used to deliver educational content or to facilitate learning.

Survey questions 5 through 10 used a 5-point Likert scale with the response options of: (1) strongly disagree, (2) disagree, (3) neutral, (4) agree, and (5) strongly agree. Questions 5 and 6 asked participants to indicate their beliefs regarding the use of digital games in the classroom. Question 7 asked participants to indicate the extent to which the listed barriers deterred them from using digital games in the classroom. Question 8 asked participants to indicate what forms of training they had received related to the use of digital games in the classroom. Questions 9 and 10 asked what training, resources, and supports teachers would need to encourage their use of digital games to deliver educational content or facilitate learning in their classrooms.

Study Participants

Study participants included preschool through twelfth-grade teachers, selected using a convenience sampling method. Convenience sampling involves the selection of subjects based on their availability, often based on geographical location (Waterfield, 2018). The participant sample for this study was obtained using select Northern Minnesota public schools.

An email was sent to superintendents requesting their support for the distribution of the survey (see Appendix B). Upon receipt of superintendent support and Institutional Review Board (IRB) approval (see Appendix I), an email was sent to principals within the approved school districts notifying them of the upcoming survey (see Appendix C). A link to the Qualtrics survey was emailed to principals and superintendents in participating districts (see Appendix D). The email to principals and superintendents included a copy of the email of support from the superintendent. Principals were asked to read the support email and then distribute the included survey link to the preschool through twelfth-grade teachers in their schools. In some instances, superintendents requested the link be sent directly to them, to forward to their school's principals. Where requested, emails with survey links were sent to the superintendents.

The first page of the online survey provided participants with information about the survey, including details on the use of data, and assured them there were no inherent risks to their participation. By completing the 10-questions in the survey, the preschool through twelfth-grade teachers provided implied consent to participate in the study.

Human Subjects Approval

The researcher completed the human subjects review training course, required by St. Cloud State University, on September 17, 2020 (see Appendix A). Upon dissertation committee approval, the researcher forwarded all required materials to the St. Cloud State University Institutional Review Board (IRB) for final approval. Written approval was granted by the IRB on October 29, 2020 (see Appendix I).

Data Collection Procedures and Analysis

The St. Cloud State University Statistical Consulting and Research Center created the online Qualtrics survey, using the instrument developed by the researcher. The Statistical Center gathered, managed, and destroyed the raw data collected by the online survey. The Statistical Center was responsible for overseeing the security of the raw data. The data were collected in the form of measurable numbers and percentages and processed using analytics, artificial intelligence, and data management package SAS® 9.4 (SAS Institute Inc., n.d.).

Procedures and Timelines

The researcher completed the required human subjects review training on September 17, 2020 (see Appendix A). Superintendents in select Northern Minnesota school districts were emailed on September 30, 2020 and asked to provide their support to distribute the 10-question survey to the preschool to twelfth-grade teachers in their districts (see Appendix B). Additional emails requesting superintendent support were sent on October 12, 2020 and October 22, 2020.

The dissertation proposal meeting was held on October 8, 2020. Upon dissertation committee approval, the required application materials were submitted to the IRB for final approval. The proposed study was approved by St. Cloud State University's IRB committee on October 29, 2020 (see Appendix I).

Upon receipt of the IRB approval, principals were emailed, notifying them of the upcoming survey (see Appendix C). A link to the Qualtrics survey was emailed to principals and superintendents in participating districts on November 17, 2020 (see Appendix D). A reminder email was sent on December 1, 2020 (see Appendix E), and a final reminder was emailed on December 9, 2020 (see Appendix F). The online survey closed on December 11, 2020.

Data were processed between January and February 2021, with chapters 4 and 5 completed during February 2021. The final oral defense occurred in March of 2021.

Chapter 4: Results

Purpose

The purpose of this study was to determine the current professional development practices, related to digital game-based learning, in select Northern Minnesota P-12 schools. This study also identified Northern Minnesota teachers' perceived barriers and benefits to the implementation of digital games and immersive learning in the classroom. Results of this study may provide administrators with insights to trainings, resources, and supports related to digital game-based learning.

Research Design

A quantitative design was selected for use in this study. Quantitative research designs provide larger sampling sizes (Roberts, 2010), permitting the researcher to make generalizations related to the data collected (Eyisi, 2016). The data were collected in the form of measurable numbers and percentages and processed using analytics, artificial intelligence, and data management package SAS® 9.4 (SAS Institute Inc., n.d.).

The researcher developed a web-based survey, adapted from previous research conducted by Dr. Min Lin Wu (2015). Dr. Wu granted permission to repurpose their survey (see Appendix H). The survey instrument used in this study was designed to provide Minnesota P-12 teachers from select districts an opportunity to offer their perceptions of digital game-based learning in a quantitative format. The study examined teachers' training and perceptions related to digital game-based learning. The study also examined the training and supports which would encourage teachers to implement digital game-based learning in their classrooms.

Reliability was tested for the measure using Cronbach's alpha for survey questions 6-10. All values were above .70, indicating a good internal consistency within the survey (see Appendix J). The survey results demonstrated a good convergent validity (see Appendix K).

Research Questions

The following research questions were used to guide this study:

1. What forms of training and to what extent do select Minnesota teachers in grades P-12 report receiving related to the integration of digital games into their curriculum?
2. What do select Minnesota teachers in grades P-12 report as the benefits of integrating educational digital games into their curriculum?
3. What do select Minnesota teachers in grades P-12 report as barriers to the integration of educational digital games into their curriculum?
4. What do select Minnesota teachers in grades P-12 report as the needed resources, supports, and trainings related to the integration of educational digital games into their curriculum?

Organization of Chapter 4

Chapter 4 results are organized around the four research questions of the study. The participants of the study are explained first, followed by an analysis of the data. Descriptive data for each of the research questions are provided in tables followed by explanations of the findings.

Study Participants

The study focused on P-12 classroom teachers in select Northern Minnesota schools. The survey link was emailed to principals and superintendents, who then forwarded the link to the survey to the teachers in their districts, with a potential of reaching 2,670 teachers. The results analyzed in this chapter were derived from the 345 respondents (approximately 12.92%); the number of respondents to complete the entire survey. Not all participants answered every question thus the responses and percentages were drawn from the total number of answers received for the particular item being analyzed as indicated by *n*.

Table 1 data reveals the participants' current teaching responsibilities by grade levels. Participants had the ability to select more than one response.

Table 1

Survey Question 1: Grade Range Currently Teaching

Answer Options	**Frequency**
Elementary (K-5)	129
Middle School (5-8)	73
High School (9-12)	73
Combined Middle School and High School (7-12)	45
K-12 or P-12	24
Early Childhood (Birth-Grade 3)	14
Preschool (Ages 3-4)	12
ALC or Other Mixed Ages	0

Note. N = 345. Participants had the ability to select more than one response.

Elementary (K-5) was the most frequently selected response, *n* = 129. The second and third most frequently identified grade levels were High School (9-12) and Middle School (5-8), with seventy-three responses each. Combined Middle School and High School (7-12) was the fourth most frequently selected grade with forty-five responses. K-12 or P-12 received twentyfour responses, Early Childhood (Birth-Grade 3) received fourteen, and Preschool (Ages 3-4) received twelve responses. Seven participants selected “Other” and specified: (a) 18-21 transition (*n* = 1); (b) college in the schools (*n* = 1); (c) instructional coach (*n* = 1); (d) K-5 interventions (*n* = 1); and (e) Special Education (*n* = 3).

Table 2 reflects the participants’ areas of specialization by content area. Participants were asked to select all content areas in which they were currently teaching.

Table 2

Survey Question 2: Area of Specialization

Answer Options	**Frequency**
Elementary Education	118
Special Education (ABS, ASD, EBD, ECSE, LD)	58
Mathematics	41
Science Education (e.g., Chemistry, Earth & Space, General Science, Life Science, Physics)	30
Communication Arts and Literature	29
Reading	24
Music Education (e.g., Classroom, Instrumental, Vocal)	23
Social Studies	21
Early Childhood Education	18
Physical Education	15
World Language and Cultures (e.g., Chinese, French, German, Spanish)	11

Table 2 Continued

Answer Options	**Frequency**
Visual Arts	9
Career and Technical Education (CTE)	8
Preschool	7
Health Education	6
Industrial Technology	6
English as a Second Language (ESL)	5
Computer, Keyboarding, and Related Technology	4
Family and Consumer Sciences (FACS)	4
Library Media Specialist	4
Business Education	3
Agricultural Education	2
Developmental and Adaptive Physical Education (DAPE)	2
Gifted and Talented	1
Speech/Theater	1

Note. N = 345. Participants were asked to select all that apply.

Elementary (K-5) was the most frequently selected response, *n* = 118. The second and third most frequently selected responses were Special Education (*n* = 58) and Mathematics (*n* = 41), respectively. Science Education was the fourth most frequently selected content area (*n* = 30), and Communication Arts and Literature was the fifth most frequently selected content area (*n* = 29). Additional responses included Reading (*n* = 24), Music Education (*n* = 23), Social

Studies (*n* = 21), Early Childhood Education (*n* = 18), Physical Education (*n* = 15), and World Languages (*n* = 11). The remaining options received less than ten responses each.

Participants also had the option to select “Other” and specify their teaching assignment. Fourteen respondents selected “Other”, indicating: (a) American Indian Education (*n* = 2); (b) driver’s education (*n* = 3); (c) instructional coach (*n* = 1); (d) interventionist (*n* = 1); (e) K-12 counselor (*n* = 1); (f) pre-engineering (*n* = 1); (g) social work (*n* = 1); (h) speech pathologist (*n* = 2); and (i) STEM [Science, Technology, Engineering, and Math] (*n* = 2).

Table 3 reflects the responses to survey question 3, which asked participants to indicate their years of teaching experience.

Table 3

Survey Question 3: Years of Teaching Experience

Answer Options	**Frequency**	**Percent**
0 – 4 years	61	17.73
5 or more years	283	82.27

Note. N = 344.

Survey question 3 asked participants to select one of two choices, to reflect their years of teaching experience. The most frequently selected response, 5 or more years of teaching experience, received 82.27% of responses (*n* = 283). The remaining participants, 17.73% (*n* = 61), indicated 0-4 years of teaching experience.

Table 4 reveals the responses to survey question 4, which provided participants with a list of devices and asked them to select all devices with which they had experience delivering educational content or facilitating learning.

Table 4

Survey Question 4: Devices Previously Used

Answer Options	**Frequency**
Desktop or Laptop Computer	342
Tablet (e.g., iPad, Chromebook, Microsoft Surface Go)	296
Interactive Whiteboard (e.g., SMART Board, Promethean)	288
Smartphone (e.g., Android, iOS, Windows)	230
Overhead Projector	226
Document Camera (e.g., Elmo)	174
Gaming Console (e.g., PlayStation, Nintendo, Xbox)	46
Virtual Reality or Augmented Reality (e.g., Google Cardboard, Oculus, HTC VIVE, Merge Cube, Microsoft HoloLens)	38
None of the above	0

Note. N = 345. Participants were asked to select all that apply.

Table 4 lists participants' experience using specific technology devices. The majority of participants (*n* = 342) had experience using desktop or laptop computers to deliver educational content or to facilitate learning. The second and third highest responses were tablet (*n* = 296) and interactive whiteboard (*n* = 288). The fourth and fifth most frequently selected responses were Smartphone (*n* = 230) and Overhead Projector (*n* = 226). Document Camera received 174 responses, Gaming Console received 46 responses, and Virtual Reality or Augmented Reality received 38 responses.

Participants also had the option to select "Other" and specify the device(s) they had experience using to deliver educational content or to facilitate learning. Four respondents selected “Other” and indicated: (a) Smart TV (*n* = 1); (b) Technology for the blind (*n* = 1); and (c) Robots or Coding Robots (e.g.: Ozbots, Sphero; *n* = 2).

Table 5 reflects survey question 2, which asked participants to rank three statements regarding their experience and interest in using digital games. Participants were asked to rank each statement based on a Likert scale: Strongly Disagree (SD); Disagree (D); Neutral (N); Agree (A); and Strongly Agree (SA).

Table 5

Survey Question 5: Experience and Interest in Using Digital Games

*	Statement	SD	D	N	A	SA	*n*
(*a*)	I strive to incorporate new digital technologies into my teaching practice	7 (2.03%)	17 (4.94%)	58 (16.86%)	190 (55.23%)	72 (20.93%)	344
(*b*)	I am interested in using digital games to deliver educational content or facilitate learning	12 (3.48%)	19 (5.51%)	71 (20.58%)	164 (47.54%)	79 (22.90%)	345
(*c*)	I have experience using a digital game to deliver educational content or facilitate learning	55 (15.94%)	61 (17.68%)	50 (14.49%)	140 (40.58%)	39 (11.30%)	345

Note: The *n* column reflects the number of respondents for each statement.
*The left-hand column is for table reference only.

The statement with the highest percentage of participants reporting agreement was (*a*) I strive to incorporate new digital technologies into my teaching practice, with 55.23% and an additional 20.93% strongly agreed, for a total of 76.16% (*n* = 262). The statement with the second-highest percentage of agreement, (*b*) I am interested in using digital games to deliver educational content or facilitate learning, received 47.54% agreed and 22.90% strongly agreed, for a total of 70.44% (*n* = 243). The third statement, receiving the third-highest percentage of agreement, was (*c*) I have experience using a digital game to deliver educational content or facilitate learning. Statement (*c*) received 40.58% agreed and 11.30% strongly agreed, for a total of 51.88% (*n* = 179).

Data Analysis

The St. Cloud State University Statistical Consulting and Research Center built the online Qualtrics survey, using the instrument developed by the researcher. The Statistical Center gathered and managed the raw data collected by the online survey. The Statistical Center was responsible for overseeing the security of the raw data, including the destruction of raw data upon publication of this dissertation. The data were collected in the form of measurable numbers and percentages and processed using analytics, artificial intelligence, and data management package SAS® 9.4 (SAS Institute Inc., n.d.).

Research Question 1: What forms of training and to what extent do select Minnesota teachers in grades P-12 report receiving related to the integration of digital games into their curriculum?

Table 6 reflects survey question 8, which asked participants to respond to the question: To what extent have you received training or professional development related to the use of digital game-based learning? Participants were asked to rank each statement based on a Likert scale: Strongly Disagree (SD); Disagree (D); Neutral (N); Agree (A); and Strongly Agree (SA).

Table 6

Survey Question 8: Training Received Related to Digital Games

*	Statement	SD	D	N	A	SA	*n*
(*a*)	Digital game-based learning was covered in-depth during my preservice teacher preparation program	192 (56.64%)	0 (0.00%)	136 (40.12%)	10 (2.95%)	1 (0.29%)	339
(*b*)	Digital game-based learning was discussed during my preservice teacher preparation program	173 (51.03%)	0 (0.00%)	137 (40.41%)	28 (8.26%)	1 (0.29%)	339
(*c*)	Digital game-based learning has been covered during professional development sessions provided by the school district	128 (37.87%)	0 (0.00%)	162 (47.93%)	46 (13.61%)	2 (0.59%)	338
(*d*)	A district technology support person encouraged me to use digital games	108 (31.95%)	0 (0.00%)	167 (49.41%)	55 (16.27%)	8 (2.37%)	338
(*e*)	A mentor or peer teacher encouraged me to use digital games	103 (30.47%)	0 (0.00%)	148 (43.79%)	79 (23.37%)	8 (2.37%)	338
(*f*)	I sought out training or experimented with the use of digital games on my own	76 (22.49%)	0 (0.00%)	112 (33.14%)	104 (30.77%)	46 (13.61%)	338

Note: The *n* column reflects the number of respondents for each statement.
*The left-hand column is for table reference only.

The statement with the highest percentage of participants reporting strongly disagreed was (*a*) digital game-based learning was covered in-depth during my preservice teacher preparation program, with 56.64% and an additional 40.12% answering neutral. The statement with the second-highest percentage of strongly disagreed was (*b*) digital game-based learning was discussed during my preservice teacher preparation program, with 51.03% and an additional 40.41% answering neutral. The statement with the third-highest response rating was (*c*) digital game-based learning has been covered during professional development sessions provided by the school district, with 37.87% strongly disagreed and 47.93% neutral. The fourth highest-ranked statement, (*d*) a district technology support person encouraged me to use digital games, received 31.95% strongly disagreed and 49.41% neutral. The fifth highest ranked statement, (*e*) a mentor or peer teacher encouraged me to use digital games, received 30.47% strongly disagreed and 43.79% neutral. The sixth and final statement, (*f*) I sought out training or experimented with the use of digital games on my own, received 22.49% strongly disagreed and 33.14% neutral; statement (*f*) also received 30.77% agreed and 13.61% strongly agreed, for a total of 44.38% (*n* = 150).

Research Question 2: What do select Minnesota teachers in grades P-12 report as the benefits of integrating educational digital games into their curriculum?

Table 7 is linked to survey question 6, which asked participants to rank statements associated with potential benefits of using digital game-based learning, based on a Likert scale: Strongly Disagree (SD); Disagree (D); Neutral (N); Agree (A); and Strongly Agree (SA).

Table 7

Survey Question 6: Perceived Benefits to Using Digital Games

*****	**Statement**	**SD**	**D**	**N**	**A**	**SA**	***n***
(*a*)	Digital games can be used as supplemental learning activities	4 (1.17%)	2 (0.58%)	30 (8.77%)	194 (56.73%)	112 (32.75%)	342
(*b*)	Digital games provide instantaneous feedback to learners	1 (0.29%)	6 (1.76%)	39 (11.44%)	196 (57.48%)	99 (29.03%)	341
(*c*)	Students are motivated by digital games	1 (0.30%)	3 (0.89%)	45 (13.31%)	171 (50.59%)	118 (34.91%)	338
(*d*)	Digital games can be used as a reward for students	4 (1.17%)	14 (4.09%)	33 (9.65%)	197 (57.60%)	94 (27.49%)	342
(*e*)	Digital games can promote learning in STEM (Science, Technology, Engineering, Mathematics) fields	3 (0.87%)	4 (1.17%)	50 (14.58%)	212 (61.81%)	74 (21.57%)	343
(*f*)	Digital games can promote personalized learning	7 (2.05%)	6 (1.75%)	50 (14.62%)	210 (61.40%)	69 (20.18%)	342
(*g*)	Digital games can be useful tools to deliver educational content or facilitate learning	4 (1.17%)	8 (2.33%)	58 (16.91%)	202 (58.89%)	71 (20.70%)	343
(*h*)	Digital games promote the use of problem-solving skills	6 (1.76%)	6 (1.76%)	59 (17.30%)	208 (61.00%)	62 (18.18%)	341

Table 7 Continued

*	Statement	SD	D	N	A	SA	*n*
(*i*)	Digital games provide opportunities for students to make connections and to apply what they are learning	5 (1.46%)	10 (2.92%)	60 (17.54%)	213 (62.28%)	54 (15.79%)	342
(*j*)	Digital games provide opportunities to learn from mistakes	6 (1.75%)	12 (3.51%)	61 (17.84%)	208 (60.82%)	55 (16.08%)	342
(*k*)	Digital games provide ongoing feedback to learners	3 (0.88%)	11 (3.22%)	68 (19.88%)	197 (57.60%)	63 (18.42%)	342
(*l*)	Digital games provide ongoing challenges for students	4 (1.17%)	8 (2.33%)	71 (20.70%)	199 (58.02%)	61 (17.78%)	343
(*m*)	Digital games promote experimental learning	6 (1.75%)	16 (4.66%)	67 (19.53%)	202 (58.89%)	52 (15.16%)	343
(*n*)	Digital games provide dynamic learning opportunities	5 (1.46%)	16 (4.66%)	74 (21.57%)	194 (56.56%)	54 (15.74%)	343
(*o*)	Digital games can be used to promote learning objectives to meet Minnesota standards	8 (2.35%)	11 (3.24%)	92 (27.06%)	186 (54.71%)	43 (12.65%)	340
(*p*)	Students are more accustomed to learning with digital technologies	3 (0.88%)	23 (6.74%)	90 (26.39%)	180 (52.79%)	45 (13.20%)	341

Table 7 Continued

*	Statement	SD	D	N	A	SA	*n*
(*q*)	Digital games provide safe environments in which students are able to fail without fear of consequences	7 (2.05%)	25 (7.31%)	87 (25.44%)	175 (51.17%)	48 (14.04%)	342
(*r*)	Digital games can be used to promote learning objectives to meet Common Core standards	8 (2.34%)	7 (2.05%)	109 (31.87%)	178 (52.05%)	40 (11.70%)	342
(*s*)	Digital games provide hands-on learning opportunities for students	15 (4.37%)	35 (10.20%)	78 (22.74%)	166 (48.40%)	49 (14.29%)	343
(*t*)	Digital games promote collaborative learning	6 (1.76%)	29 (8.53%)	98 (28.82%)	164 (48.24%)	43 (12.65%)	340
(*u*)	Digital games provide me with a strong platform to engage my students	15 (4.37%)	30 (8.75%)	93 (27.11%)	155 (45.19%)	50 (14.58%)	343
(*v*)	Digital games promote inquiry	4 (1.17%)	36 (10.53%)	98 (28.65%)	176 (51.46%)	28 (8.19%)	342
(*w*)	Students are more accustomed to learning with other technologies (outside of digital games)	5 (1.47%)	26 (7.62%)	123 (36.07%)	145 (42.52%)	42 (12.32%)	341
(*x*)	Digital games promote creativity	7 (2.05%)	46 (13.45%)	106 (30.99%)	153 (44.74%)	30 (8.77%)	342

Table 7 Continued

*	Statement	SD	D	N	A	SA	*n*
(*y*)	Using digital games helps me relate to my students	24 (7.10%)	47 (13.91%)	125 (36.98%)	111 (32.84%)	31 (9.17%)	338

Note: The *n* column reflects the number of respondents for each statement.
*The left-hand column is for table reference only.

Statement (*a*) digital games can be used as supplemental learning activities had the highest percentage of participants reporting agreement with 56.73% and an additional 32.75% indicating strongly agreed, for a total of 89.48% (*n* = 306). The second most frequently selected response was (*b*) digital games provide instantaneous feedback to learners with 57.48% agreed and 29.03% strongly agreed, for a total of 86.51% (*n* = 295). Statement (*c*) students are motivated by digital games was the third-highest ranked, receiving 50.59% agreed and 34.91% strongly agreed, for a total of 85.50% (*n* = 289). The fourth most frequently indicated response, (*d*) digital games can be used as a reward for students, garnered 57.60% agreed and 27.49% strongly agreed, for a total of 85.09% (*n* = 291). The fifth highest ranked statement, (*e*) digital games can promote learning in STEM (Science, Technology, Engineering, Mathematics) fields, received 61.81% agreed and 21.57% strongly agreed, for a total of 83.38% (*n* = 286). The sixth-highest ranked statement, (*f*) digital games can promote personalized learning, received 61.40% agreed and 20.18% strongly agreed, for a total of 81.58% (*n* = 279).

Statement (*g*), digital games can be useful tools to deliver educational content or facilitate learning, received 58.89% agreed and 20.70% strongly agreed, for a total of 79.59% (*n* = 273). Responses to statement (*h*), digital games promote the use of problem-solving skills, indicated 61.00% agreed and 18.18% strongly agreed, for a total of 79.18% (*n* = 270). Statement (*i*), digital games provide opportunities for students to make connections and to apply what they are learning, received 62.28% agreed and 15.79% strongly agreed, for a total of 78.07% (*n* = 267). Statement (*j*), digital games provide opportunities to learn from mistakes, received 60.82% agreed and 16.08% strongly agreed, for a total of 76.90% (*n* = 263). Statement (*k*), digital games provide ongoing feedback to learners, obtained 57.60% agreed and 18.42% strongly agreed, for a total of 76.02% (*n* = 260). Statement (*l*), digital games provide ongoing challenges for students, received 58.02% agreed and 17.78% strongly agreed, for a total of 75.80% (*n* = 260). Statement (*m*), digital games promote experimental learning, received 58.89% agreed and 15.16% strongly agreed, for a total of 74.05% (*n* = 254). Statement (*n*), digital games provide dynamic learning opportunities, indicated 56.56% agreed and 15.74% strongly agreed, for a combined 72.30% (*n* = 248).

Responses to survey question 6, statement (*o*), digital games can be used to promote learning objectives to meet Minnesota standards, revealed 54.71% agreed and 12.65% strongly agreed, for a total of 67.36% (*n* = 229). Statement (*p*), students are more accustomed to learning with digital technologies, obtained 52.79% agreed and 13.20% strongly agreed, for a total of 65.99% (*n* = 225). Statement (*q*), digital games provide safe environments in which students are able to fail without fear of consequences, indicated 51.17% agreed and 14.04% strongly agreed, a total of 65.21% (*n* = 223). Statement (*r*), digital games can be used to promote learning objectives to meet Common Core standards, received 52.05% agreed and 11.70% strongly agreed, for a total of 63.75% (*n* = 218). Statement (*s*), digital games provide hands-on learning opportunities for students, garnered 48.40% agreed and 14.29% strongly agreed, for a total of

62.69% (*n* = 215). Statement (*t*), digital games promote collaborative learning, received 48.24% agreed and 12.65% strongly agreed, a total of 60.89% (*n* = 207).

Survey question 6, statement (*u*), digital games provide me with a strong platform to engage my students, received 45.19% agreed and 14.58% strongly agreed, for a total of 59.77% (*n* = 205). Statement (*v*), digital games promote inquiry, garnered 51.46% agreed and 8.19% strongly agreed, a total of 59.65% (*n* = 204). Statement (*w*), students are more accustomed to learning with other technologies (outside of digital games), received 42.52% agreed and 12.32% strongly agreed, for a combined 54.84% (*n* = 187). Statement (*x*), digital games promote creativity, obtained 44.74% agreed and 8.77% strongly agreed, a total of 53.51% (*n* = 183). Statement (*y*), using digital games helps me relate to my students, received 32.84% agreed and 9.17% strongly agreed, for a total of 42.01% (*n* = 142).

Research Question 3: What do select Minnesota teachers in grades P-12 report as barriers to the integration of educational digital games into their curriculum?

Research question three aligns to survey question 7, which asked participants to rank the barriers or deterrents to implementing digital games in the classroom. Participants were asked to rank each statement based on a Likert scale: Strongly Disagree (SD); Disagree (D); Neutral (N); Agree (A); and Strongly Agree (SA).

Table 8

Survey Question 7: Deterrents or Barriers to Using Digital Games

*****	**Statement**	**SD**	**D**	**N**	**A**	**SA**	***n***
(*a*)	Cost of purchasing games and/or licenses	5 (1.47%)	14 (4.11%)	45 (13.20%)	163 (47.80%)	114 (33.43%)	341
(*b*)	Cost of equipment (e.g., game consoles, computers, tablets, etc.)	5 (1.47%)	14 (4.11%)	48 (14.08%)	150 (43.99%)	124 (36.36%)	341
(*c*)	Lack of professional development on the use of digital games	5 (1.48%)	24 (7.10%)	47 (13.91%)	184 (54.44%)	78 (23.08%)	338
(*d*)	Lack of teacher training on the use of digital games during teacher preparation program	6 (1.76%)	22 (6.47%)	57 (16.76%)	175 (51.47%)	80 (23.53%)	340
(*e*)	Lack of training to make informed choices regarding selection of digital games	5 (1.47%)	26 (7.67%)	55 (16.22%)	181 (53.39%)	72 (21.24%)	339
(*f*)	Violence in video games is a deterrent	24 (7.08%)	48 (14.16%)	75 (22.12%)	120 (35.40%)	72 (21.24%)	339
(*g*)	Inadequate technology support to run digital games in the classroom	10 (2.96%)	59 (17.46%)	80 (23.67%)	137 (40.53%)	52 (15.38%)	338
(*h*)	Digital games require additional lesson planning time	8 (2.37%)	55 (16.27%)	98 (28.99%)	131 (38.76%)	46 (13.61%)	338

Table 8 Continued

*	Statement	SD	D	N	A	SA	*n*
(*i*)	Lack of alignment with curriculum or state standards	6 (1.77%)	48 (14.16%)	114 (33.63%)	132 (38.94%)	39 (11.50%)	339
(*j*)	Parents' negative perceptions of using digital games as educational tools	27 (7.94%)	90 (26.47%)	112 (32.94%)	95 (27.94%)	16 (4.71%)	340
(*k*)	Short class periods hinder the use of digital games	23 (6.80%)	94 (27.81%)	111 (32.84%)	90 (26.63%)	20 (5.92%)	338
(*l*)	Digital games cause classroom management issues	35 (10.39%)	121 (35.91%)	102 (30.27%)	67 (19.88%)	12 (3.56%)	337
(*m*)	Lack of administrative support to use digital games for teaching	29 (8.53%)	118 (34.71%)	117 (34.41%)	59 (17.35%)	17 (5.00%)	340
(*n*)	Technology distracts students from meeting learning goals	26 (7.65%)	127 (37.35%)	111 (32.65%)	61 (17.94%)	15 (4.41%)	340
(*o*)	Administrators' negative perceptions of using digital games as educational tools	32 (9.38%)	107 (31.38%)	127 (37.24%)	64 (18.77%)	11 (3.23%)	341
(*p*)	Fellow teachers' negative perceptions of using digital games as educational tools	39 (11.44%)	120 (35.19%)	109 (31.96%)	61 (17.89%)	12 (3.52%)	341

Table 8 Continued

*	Statement	SD	D	N	A	SA	*n*
(*q*)	Digital game-based learning cannot meet desired learning outcomes	26 (7.67%)	122 (35.99%)	125 (36.87%)	55 (16.22%)	11 (3.24%)	339
(*r*)	Playing digital games has a negative influence on students	26 (7.69%)	141 (41.72%)	109 (32.25%)	49 (14.50%)	13 (3.85%)	338

Note: The *n* column reflects the number of respondents for each statement.
*The left-hand column is for table reference only.

The statement receiving the highest percentage of participants reporting agreement was (*a*) cost of purchasing games and/or licenses was the highest-ranked response, with 47.80% and an additional 33.43% strongly agreed, for a total of 81.23% (*n* = 277). The statement with the second-highest percentage of agreement, (*b*) cost of equipment, received 43.99% agreed and 36.36% strongly agreed, a combined 80.35% (*n* = 274). The third most frequently indicated statement, (*c*) lack of professional development on the use of digital games, garnered 54.44% agreed and 23.08% strongly agreed, for a total of 77.52% (*n* = 262). The fourth most frequently indicated statement, (*d*) lack of teacher training on the use of digital games during teacher preparation program, received 51.47% agreed and 23.53% strongly agreed, for 75.00% (*n* = 255) total. The fifth most frequently indicated statement, (*e*) lack training to make informed choices regarding selection of digital games, earned 53.39% agreed and 21.24% strongly agreed, for a total of 74.63% (*n* = 253).

Statement (*f*), violence in video games is a deterrent, received 35.40% agreed and 21.24% strongly agreed, for a total of 56.64% (*n* = 192). Statement (*g*), inadequate technology support to run digital games in the classroom, obtained 40.53% agreed and 15.38% strongly agreed, a combined 55.91% (*n* = 189). Statement (*h*), digital games require additional lesson planning time, received 38.76% agreed and 13.61% strongly agreed, a total of 52.37% (*n* = 177). Statement (*i*), lack of alignment with curriculum or state standards, earned 38.94% agreed and 11.50% strongly agreed, a total of 50.44% (*n* = 171).

Survey question 7, statement (*j*), parents' negative perceptions of using digital games as educational tools, received 27.94% agreed and 4.71% strongly agreed, a total of 32.65% (*n* = 111). Statement (*k*), short class periods hinder the use of digital games, garnered 26.63% agreed and 5.92% strongly agreed, a combined 32.55% (*n* = 110). Statement (*l*), digital games cause classroom management issues, garnered 19.88% agreed and 3.56% strongly agreed, a total of 23.44% (*n* = 79). Statement (*m*), lack of administrative support to use digital games for teaching, received 17.35% agreed and 5.00% strongly agreed, a total of 22.35% (*n* = 76). Statement (*n*), technology distracts students from meeting learning goals, also earned 17.94% agreed and 4.41% strongly agreed, a combined 22.35% (*n* = 76). Statement (*o*), administrators' negative perceptions of using digital games as educational tools, received 18.77% agreed and 3.23% strongly agreed, a total of 22.00% (*n* = 75). Statement (*p*), fellow teachers' negative perceptions of using digital games as educational tools, garnered 17.89% agreed and 3.52% strongly agreed, for 21.41% (*n* = 73) total. Statement (*q*), digital game-based learning cannot meet desired learning outcomes, received 16.22% agreed and 3.24% strongly agreed, a total of 19.46% (*n* = 66). Finally, statement (*r*), playing digital games has a negative influence on students, received 14.50% agreed and 3.85% strongly agreed, for a total of 18.35% (*n* = 62). Of note, statements (*j*) through (*r*) all received between 30.27% and 37.24% neutral responses.

Respondents who selected “Other” indicated: (a) a lack of funding or access to technology (*n* = 2); (b) a lack of or difficulty finding games aligned to their grade level and/or content area (*n* = 8); and (c) concerns over increased screen time (*n* = 7). Additional responses included difficulty in purchasing games or apps in their district (*n* = 1) and concern over negative consequences on students’ self-esteem.

Research Question 4: What do select Minnesota teachers in grades P-12 report as the needed resources, supports, and trainings related to the integration of educational digital games into their curriculum?

Research question four aligns to survey questions 9 and 10, which asked respondents to rank training and supports which would encourage their use of digital games in the classroom.

Table 9 aligns to survey question 9, which asked participants: To what extent would the following training options encourage you to use digital games to deliver educational content or facilitate learning in your classroom? Participants were asked to rank each statement based on a Likert scale: Strongly Disagree (SD); Disagree (D); Neutral (N); Agree (A); and Strongly Agree (SA).

Table 9

Survey Question 9: Training Which Would Encourage Use of Digital Games

*	Statement	SD	D	N	A	SA	*n*
(*a*)	Professional development provided by the school district	11 (3.24%)	21 (6.18%)	46 (13.53%)	184 (54.12%)	78 (22.94%)	340
(*b*)	Technology support personnel to provide ongoing support	13 (3.82%)	21 (6.18%)	48 (14.12%)	192 (56.47%)	66 (19.41%)	340
(*c*)	A mentor or peer teacher to provide ongoing support	13 (3.82%)	24 (7.06%)	49 (14.41%)	199 (58.53%)	55 (16.18%)	340
(*d*)	Online training options	17 (5.00%)	47 (13.82%)	87 (25.59%)	153 (45.00%)	36 (10.59%)	340
(*e*)	Summer training options	34 (10.09%)	63 (18.69%)	97 (28.78%)	118 (35.01%)	25 (7.42%)	337
(*f*)	Coursework provided by a college or university	37 (10.91%)	68 (20.06%)	99 (29.20%)	113 (33.33%)	22 (6.49%)	339
(*g*)	Weekend training options	64 (18.88%)	124 (36.58%)	94 (27.73%)	48 (14.16%)	9 (2.65%)	339
(*h*)	I have no plans to use digital games in my classroom	98 (29.17%)	107 (31.85%)	87 (25.89%)	29 (8.63%)	15 (4.46%)	336

Note: The *n* column reflects the number of respondents for each statement.
*The left-hand column is for table reference only.

The statement with the highest percentage of agreement was (*a*) professional development provided by the school district, with 54.12% and an additional 22.94% strongly agreed, for a total of 77.06% (*n* = 262). The statement with the second-highest percentage of agreement, (*b*) technology support personnel to provide ongoing support, received 56.47% agreed and 19.41% strongly agreed, a combined 75.88% (*n* = 258). The third most frequently indicated statement, (*c*) a mentor or peer teacher to provide ongoing support, received 58.53% agreed and 16.18% strongly agreed, a combined 74.71% (*n* = 254). The fourth most frequently indicated statement, (*d*) online training options, earned 45.00% agreed and 10.59% strongly agreed, a total of 55.59% (*n* = 189).

Statement (*e*) summer training options received 35.01% agreed and 7.42% strongly agreed, for a total of 42.43% (*n* = 143). Statement (*f*), coursework provided by a college or university, obtained 33.33% agreed and 6.49% strongly agreed, a combined 39.82% (*n* = 135). Statement (*g*), weekend training options, received 14.16% agreed and 2.65% strongly agreed, a total of 16.81% (*n* = 57). Statement (*h*) I have no plans to use digital games in my classroom received 8.63% agreed and 4.46% strongly agreed, a total of 13.09% (*n* = 44).

Respondents who selected “Other” indicated: (a) time dedicated to integrating digital games (*n* = 4); (b) funding dedicated to digital gaming (*n* = 1); and (c) a lack of digital games related to American Indian content (*n* = 1).

Table 10 aligns to survey question 10, which asked participants: To what extent would the following support options encourage you to use digital games to deliver educational content or facilitate learning in your classroom? Participants were asked to rank each statement based on a Likert scale: Strongly Disagree (SD); Disagree (D); Neutral (N); Agree (A); and Strongly Agree (SA).

Table 10

Survey Question 10: Supports Which Would Encourage Use of Digital Games

*	Statement	SD	D	N	A	SA	*n*
(*a*)	Time to explore and plan for digital game implementation	9 (2.65%)	6 (1.76%)	24 (7.06%)	157 (46.18%)	144 (42.35%)	340
(*b*)	Pre-made lesson plans aligned to specific content area and grade level	11 (3.24%)	7 (2.06%)	29 (8.53%)	136 (40.00%)	157 (46.18%)	340
(*c*)	Additional funding to purchase games and/or licenses	10 (2.93%)	16 (4.69%)	39 (11.44%)	144 (42.23%)	132 (38.71%)	341
(*d*)	Additional funding to purchase equipment	10 (2.93%)	17 (4.99%)	47 (13.78%)	147 (43.11%)	120 (35.19%)	341
(*e*)	Administrator support	11 (3.24%)	14 (4.12%)	74 (21.76%)	167 (49.12%)	74 (21.76%)	340
(*f*)	Improved perceptions of parents	11 (3.24%)	36 (10.59%)	109 (32.06%)	137 (40.29%)	47 (13.82%)	340
(*g*)	Improved perceptions of administrators	13 (3.81%)	38 (11.14%)	121 (35.48%)	124 (36.36%)	45 (13.20%)	341
(*h*)	Improved perceptions of fellow teachers	15 (4.40%)	39 (11.44%)	125 (36.66%)	119 (34.90%)	43 (12.61%)	341

Note: The *n* column reflects the number of respondents for each statement.
*The left-hand column is for table reference only.

The statement with the highest percentage of participants reporting agreement was (*a*) time to explore and plan for digital game implementation, with 46.18% and an additional 42.35% strongly agreed, for a total of 88.53% (*n* = 301). The statement with the second-highest percentage of agreement, (*b*) pre-made lesson plans aligned to specific content area and grade level, received 40.00% agreed and 46.18% strongly agreed, a combined 86.18% (*n* = 293). The third statement, (*c*) additional funding to purchase games and/or licenses, garnered 42.23% agreed and 38.71% strongly agreed, for a total of 80.94% (*n* = 276). The fourth statement, (*d*) additional funding to purchase equipment, received 43.11% agreed and 35.19% strongly agreed, for 78.30% (*n* = 267) total. The fifth statement, (*e*) administrator support, earned 49.12% agreed and 21.76% strongly agreed, for a total of 70.88% (*n* = 241).

Survey question 10 statement (*f*) improved perceptions of parents received 40.29% agreed and 13.82% strongly agreed, a total of 54.11% (*n* = 184). Statement (*g*), improved perceptions of administrators, garnered 36.36% agreed and 13.20% strongly agreed, a combined 49.56% (*n* = 169). Statement (*h*), improved perceptions of fellow teachers, garnered 34.90% agreed and 12.61% strongly agreed, a total of 47.51% (*n* = 162).

Respondents who selected “Other” indicated: (a) a digital games club for interested students; (b) more likely to use with distance learners than in-person students; and (c) a desire to see research showing digital gaming is a better option for learning than hands-on experiential learning.

Summary

This chapter provided the results of the study which examined teacher training practices aligned to digital game-based learning, teachers’ perceptions regarding the benefits and barriers to integration of digital game-based learning in the classroom, and the training and supports teachers needed to implement digital game-based learning into their classrooms. The literature review discussed the lack of teacher training, both preservice and in-service, related to digital game-based learning. It also outlined potential benefits to the implementation of digital game-based learning, as well as potential barriers to integration.

Chapter five summarizes the findings, compares findings with the related literature, presents conclusions, and provides recommendations for future research and professional practice.

Chapter 5: Discussions, Conclusions, and Recommendations

Introduction

The review of literature outlined numerous potential benefits to digital game-based learning including the ability to engage (Chmiel, 2015) and motivate learners (Karagiorgas & Niemann, 2017), providing opportunities for collaboration and social development (Chmiel, 2015), and allowing learners to exercise critical-thinking and problem-solving skills (Lu & Liu, 2015). Digital games provide ongoing, real-time feedback (Weitze, 2014) and differentiation (Malykhina, 2014), as well as encouraging autonomy (De Grove et al., 2012) and promoting new forms of literacy (Gee, 2003). The enjoyment students experience when playing digital games may provide initial motivation, which may then be nurtured to promote a love of learning (Karagiorgas & Niemann, 2017, p. 515).

Educators face multiple barriers to the successful implementation of digital games and immersive technologies in the classroom (Becker, 2007; Cowan, 2008; Darling-Hammond et al., 2017; Groff et al., 2010; Groff et al., 2016; Joyce et al., 2009). A significant barrier identified by the review of the literature was a lack of training and professional development for teachers aligned to the implementation of digital game-based learning (An, 2018; Groff, 2018; Meredith, 2016; Takeuchi & Vaala, 2014). When educators have received training associated with proper implementation of DGBL, teachers' comfort and confidence increases (An, 2018), implementation is more effective, and student outcomes increase (Darling-Hammond et al., 2017; Rutherford et al., 2017; Stieler-Hunt & Jones, 2019).

Purpose of the Study

The purpose of this study was to determine the current professional development practices, related to digital game-based learning, in select Northern Minnesota P-12 schools. This study also identified Northern Minnesota teachers' perceived barriers and benefits to the implementation of digital games and immersive learning in the classroom. Results of this study may provide administrators with insights to trainings, resources, and supports related to digital game-based learning.

Research Design

A quantitative design was selected for use in this study. Quantitative research designs provide larger sampling sizes (Roberts, 2010), permitting the researcher to make generalizations regarding the data collected (Eyisi, 2016). The data were collected in the form of measurable numbers and percentages and processed using analytics, artificial intelligence, and data management package SAS® 9.4 (SAS Institute Inc., n.d.).

The researcher developed a web-based survey, adapted from previous research conducted by Dr. Min Lin Wu (2015). Dr. Wu granted permission to repurpose their survey (see Appendix H). The survey instrument used in this study was designed to provide Minnesota P-12 teachers from select districts an opportunity to offer their quantitative perceptions of digital game-based learning.

This study examined the forms and extent of teachers' training as well as their perceptions related to the potential benefits and barriers to the implementation of digital game-based learning. The study also examined the training and supports teachers reported were needed to implement digital game-based learning in their classrooms.

Research Questions

The following research questions were used to guide this study:

1. What forms of training and to what extent do select Minnesota teachers in grades P-12 report receiving related to the integration of digital games into their curriculum?
2. What do select Minnesota teachers in grades P-12 report as the benefits of integrating educational digital games into their curriculum?
3. What do select Minnesota teachers in grades P-12 report as barriers to the integration of educational digital games into their curriculum?
4. What do select Minnesota teachers in grades P-12 report as the needed resources, supports, and trainings related to the integration of educational digital games into their curriculum?

Conclusions and Implications

This section reviews each research question and makes connections to recent research, as well as observations from the researcher regarding the study's results.

Research Question 1: What forms of training and to what extent do select Minnesota teachers in grades P-12 report receiving related to the integration of digital games into their curriculum?

The results of the study revealed a lack of teacher training, both teacher preparation and professional development, aligned to digital game-based learning. Table 6 presents teachers' responses regarding the training they had received relating to DGBL. A significant percentage of participants reported strongly disagreed or neutral when asked if DGBL was either discussed (91.44%) or covered in-depth (96.76%) during their preservice teacher preparation program.

These data support research discussed during the literature review; teachers do not feel prepared by their teacher preparation program to properly integrate digital game technologies into their classrooms (Grunwald Associates LLC, 2010; Project Tomorrow®, 2016; Samsung, 2015; Takeuchi & Vaala, 2014). A future study, collecting data related to participants' ages, might reveal interesting insights into the impact of a teacher’s age and when they received their teacher preparation training.

This study found professional development aligned to the use of DGBL was also lacking, with 85.80% of participants indicating strongly disagreed or neutral. This finding is significant given the percentage of survey respondents (82.27%) who indicated 5 or more years of teaching experience (Table 3). These results also support findings of the review of the literature (An, 2018; Meredith, 2016; Takeuchi & Vaala, 2014). Similarly, a majority of respondents (81.36%) strongly disagreed or were neutral when asked if a district technology support person encouraged them to use digital games (Table 6). Study participants responded strongly disagreed or neutral (74.26%) to a mentor or peer teacher encouraging them to use games. The data collected as a result of this study indicate a greater lack of peer support in Minnesota as compared to research conducted by the Joan Ganz Cooney Center, which found 33% of 694 American teachers surveyed learned about digital games from another teacher, coach, or supervisor (Takeuchi & Vaala, 2014). Question 8 (Table 6) of this study asked participants to rate the forms and extent of training they had received related to the use of digital games. Interestingly, no responses were received under disagree for any of the six options listed under survey question 8. Finally, a higher percentage of teachers in this study indicated they sought out training or experimented with DGBL on their own, with 44.38% agreeing or strongly agreeing. The Joan Ganz Cooney Center findings indicated 23% of teachers “figured it out” on their own.

Research Question 2: What do select Minnesota teachers in grades P-12 report as the benefits of integrating educational digital games into their curriculum?

As Table 5 reveals, study participants indicated they agreed or strongly agreed they strive to incorporate new digital technologies into their teaching practice (76.16%) and were interested in using digital games to deliver educational content or facilitate learning (70.44%). Just over half (51.88%) of respondents agreed or strongly agreed they had experience using a digital game to deliver educational content or facilitate learning, considerably lower than the 74% of the 694 respondents from the Joan Ganz Cooney Center study (Takeuchi & Vaala, 2014). The decrease in the percentage of teachers with experience using digital games is surprising, considering the Joan Ganz Cooney Center study was conducted in the fall of 2013, seven years before the completion of this study.

Table 7 provides data showing the majority of survey completers, 81% and above, agreed or strongly agreed with six of the statements, including digital games: are useful as supplemental learning activities (89.48%), provide instantaneous feedback to learners (86.51%), motivate students (85.50%), can be used as a reward for students (85.09%), promote learning in the STEM (Science, Technology, Engineering, Mathematics) fields (83.38%), and promote personalized learning (81.58%). Further, between 72% and 79% of study participants agreed or strongly agreed with eight statements, including digital games: are useful tools to deliver educational content or facilitate learning (79.59%), promote the use of problem-solving skills (79.18%), provide opportunities for students to make connections and to apply what they are learning

(78.07%), provide opportunities to learn from mistakes (76.90%), provide ongoing feedback for learners (76.32%), provide challenges for students (75.80%), promote experimental learning (74.05%), and provide dynamic learning opportunities (72.30%). Additionally, results revealed between 62% and 67% of study participants agreed or strongly agreed with the following six statements: digital games promote learning objectives to meet Minnesota standards (67.36%), students are more accustomed to learning with digital technologies (65.99%), digital games provide safe environments in which students are able to fail without fear of consequences (65.21%), digital games promote learning objectives to meet Common Core standards (63.75%), digital games provide hands-on learning opportunities for students (62.69%), and digital games promote collaborative learning (60.89%). Statements receiving between 53% and 59% agreed or strongly agreed included: digital games provide me with a strong platform to engage my students (59.77%), digital games promote inquiry (59.65%), students are more accustomed to learning with other technologies (outside of digital games) (54.84%), and digital games promote creativity (53.51%). The final statement, using digital games helps me relate to my students, received the lowest agreed and strongly agreed ranking with 42.01%.

The highest-ranked benefit in the current study was the use of digital games as supplemental learning activities (89.48%, *n* = 306). This finding coincides with the review of related literature, which indicated digital games could be used to supplement learning. The Joan Ganz Cooney Center study, conducted in the fall of 2013, determined 45% of teachers used digital games to teach supplemental content (Takeuchi & Vaala, 2014, p. 19). Wu (2015) reported 90.5% of teachers surveyed believed digital games could be used as supplemental learning materials.

The current study's participants ranked digital games' usefulness in promoting learning objectives to meet MN standards as 15th out of 25 proposed benefits (67.36%, *n* = 229). The current study's participants also ranked digital games' usefulness in promoting learning objectives to meet Common Core standards as 18th of 25 proposed benefits (63.75%, *n* = 218). The Cooney Center study also found 43% of teachers used digital games to teach local, state, and national standards-based curricula (Takeuchi & Vaala, 2014, p. 19). Wu (2015) reported 81% of teachers agreed digital games could be used to promote Common Core learning objectives.

Overall, participants in this study ranked the benefits provided very highly, with 14 of 25 benefits receiving 70% or more agree or strongly agree. Only one benefit received less than 50% agree or strongly agree: (*y*) using digital games helps me relate to my students. Results of this study indicate Minnesota teachers perceive numerous benefits to using digital games in the classroom. However, a little more than half of the study participants (51.88%) indicated having experience using a digital game to deliver educational content or facilitate learning.

Research Question 3: What do select Minnesota teachers in grades P-12 report as barriers to the integration of educational digital games into their curriculum?

The review of the literature revealed numerous barriers to the implementation of DGBL in the classroom. Results of the study, presented in Table 8, indicated participants agreed or strongly agreed the two most significant barriers to the implementation of DGBL were the cost of purchasing games or licenses (81.23%) and the cost of equipment (80.35%). Funding and resource issues were also reported as potential barriers in the review of the literature (Becker, 2007; Egenfeldt-Nielsen, 2006; Joyce et al., 2009). The Joan Ganz Cooney Center attributing cost as the greatest barrier to teachers in grades K-8 at 50% (Millstone, 2012) and Wu (2015) found cost was a barrier to digital game integration for 73.28% of teachers. The results of this study indicated lack of funding was a more significant barrier than in the Joan Ganz Cooney Center study conducted seven years prior, in the fall of 2013. Additional significant barriers to implementation (agreed and strongly disagreed) included: a lack of professional development related to the use of digital games (77.52%), a lack of teacher training during teacher preparation programs (75.00%), and a lack of training to make informed choices regarding the selection of digital games (74.63%). These data support previous research discussed in the literature review (An, 2018; Meredith, 2016; Takeuchi & Vaala, 2014; Wu, 2015).

Further deterrents reported by participants (agreed and strongly agreed) included: concerns over violence (56.64%), inadequate technology support to run digital games in the classroom (55.91%), and digital games require additional lesson planning time (52.37%). A lack of alignment with curriculum or state standards earned 38.94% agreed and 11.50% strongly agreed, a total of 50.44% (*n* = 171). The review of literature examined several studies, with mixed results, linked to concerns over violence (Chang & Bushman, 2019; Ferguson & Wang, 2019; Lobel et al., 2017; Shao & Wang, 2019; Tobias et al., 2014). The literature review also included issues connected to limited technology support (An, 2018; Cowan, 2008; Groff, 2018; Groff et al., 2010; Joyce et al., 2009; Meredith, 2016; Takeuchi & Vaala, 2014; Wu, 2015). A lack of planning time (Pressey, 2013) and a lack of alignment with curriculum or standards (Baek, 2008; Joyce et al., 2009; Wu, 2015) were also discussed. Concerns over video game addiction were also expressed in related literature (Ervin, 2017; Nguyen, 2017; Thorsteinsson & Davey, 2014). The survey instrument did not specifically ask about concerns aligned to addiction, but participants were provided with the option to indicate other and specify the barrier(s) they experienced; seven participants indicated concerns over screen time.

The review of related literature revealed negative perceptions of parents, administrators, and fellow teachers were a potential barrier to the implementation of DGBL (Groff et al., 2016; SIIA, 2009). Perceptions might be improved with education outlining the benefits and effective uses of DGBL. The results of this study revealed Minnesota teachers were minimally impacted by others' negative perceptions. Respondents indicated agreed and strongly agreed to parents' negative perceptions (32.65%), administrators' negative perceptions (22.00%), and fellow teachers' negative perceptions (21.41%). Additional concerns reported (agreed and strongly agreed) included: short class periods hinder the use of digital games (32.55%), digital games cause classroom management issues (23.44%), a lack of administrative support to use digital games for teaching (22.35%), digital game-based learning cannot meet desired learning outcomes (19.46%), and playing digital games has a negative influence on students (18.35%).

The three significant barriers discussed in the review of literature were concerns over violence, addiction, and a lack of training aligned to DGBL. The results of this study support concern over violence and a lack of training. However, lack of funding to purchase games, licenses, and equipment were the most significant barriers reported by Minnesota teachers.

Research Question 4: What do select Minnesota teachers in grades P-12 report as the needed resources, supports, and trainings related to the integration of educational digital games into their curriculum?

Results of this study, shown in Table 9, align with the review of related literature findings revealing a lack of teacher training and supports aligned to DGBL implementation. This study found teachers would be encouraged (agreed and strongly agreed) to use digital games in the classroom if they were provided with the following training options: professional development provided by the school district (77.06%), access to ongoing support from technology personnel (75.88%) or mentor/peer teacher (74.71%), and access to online training options (55.59%). Less desirable options (agreed and strongly agreed) included summer training options (42.43%), coursework provided by a college or university (39.82%), and weekend training options (16.81%). The lowest rated statement, I have no plans to use digital games in my classroom, received a total of 13.09% agreed and strongly agreed, indicating the majority of teachers would use digital games if provided appropriate training.

Table 10 offers data outlining desired supports which would encourage the use of digital games. The highest-ranked responses (agreed and strongly agreed) included: time to explore and plan for digital game implementation (88.53%), pre-made lesson plans aligned to the specific content area and grade level (86.18%), additional funding to purchase games and/or licenses (80.94%), additional funding to purchase equipment (78.30%), and administrator support (70.88%). Statements ranked of moderate importance (agreed and strongly agreed) included: improved perceptions of parents (54.11%), improved perceptions of administrators (49.56%), and improved perceptions of fellow teachers (47.51%).

Limitations

Limitations of the survey include:

1. Teachers were surveyed between November and December 2020, during the COVID-19 pandemic.

2. The distribution of the survey link was reliant upon principals and superintendents forwarding the email with the survey link.

Recommendations for Practice

The following recommendations for practice are offered based on the related literature and the conclusions of this study:

1. The review of the literature indicated a lack of teacher training and professional development aligned to the use of digital games in education (An, 2018; Meredith, 2016; Takeuchi & Vaala, 2014). This study found a lack of teacher training, both in teacher preparation programs and in professional development, related to the implementation of digital games in the classroom. Participants indicated professional development as the top form of training which would encourage their use of digital games. It is recommended school district leaders work to include professional development offerings aligned to the integration of digital games in the classroom (e.g., games played on gaming consoles, personal computers, portable devices, and immersive learning technologies).
2. The review of the literature indicated teachers needed additional technology support (An, 2018; Cowan, 2008; Groff, 2018; Groff et al., 2010; Joyce et al., 2009; Meredith, 2016; Takeuchi & Vaala, 2014). The study participants indicated technology support personnel providing training and ongoing support within the district as the second form of training which would encourage their use of digital games. It is recommended school district leaders work to incorporate technology support personnel prepared to train and support teachers in the use of digital games in the classroom.

3. The review of the literature indicated teachers needed more time to explore digital games and plan for their use in the classroom (Egenfeldt-Nielsen, 2006; Lu & Liu, 2015; Millstone, 2012; Pressey, 2013). The study participants indicated time to explore digital games as the number one support which would encourage them to use digital games in the classroom. It is recommended school district leaders consider allotting time for teachers specifically for the exploration of digital games to deliver educational content or to facilitate learning.

Recommendations for Further Research

The following recommendations for further research are offered based on the related literature and the conclusions of this study:

1. Further research is needed to examine how teachers' concern about students' video game addiction impacts their use of digital games in the classroom.
2. Further research in multiple school districts who have implemented DGBL is needed to evaluate professional development programs for DGBL and how they align with the recommendations for effective professional development (Darling-Hammond et al., 2017).
3. A study should be conducted in a school district using DGBL to investigate how frequently digital games are used and how professional development trainings have impacted teachers' use of digital games.
4. A study should be conducted to determine the types of digital games teachers use (e.g., Serious Games, COTS, MMORPGs, AR, MR, VR) and how these digital games align with training the teachers received aligned to DGBL.

5. The replication of this study in other states in the United States is recommended.
6. A replication of this study should be conducted using a qualitative or mixed methods approach which would allow participants to provide more details related to the DGBL trainings, resources, and supports which they found most beneficial.

Concluding Remarks

This study sought to determine DGBL training received by select Northern Minnesota P-12 teachers, both teacher preparation programs and school district professional development trainings. The study also examined teachers' perceptions concerning the barriers to implementation and benefits of integrating DGBL in the classroom.

Select Northern Minnesota teachers reported a lack of training, both preservice teacher education and in professional development offered by school districts, aligned to DGBL. These findings support previous research conducted by Takeuchi and Vaala (2014) and Meredith (2016). However, a higher percentage of Northern Minnesota teachers sought out training or experimented on their own, compared with the Joan Ganz Cooney Center study (Millstone 2012). Despite a lack of training associated with the implementation of DGBL, the majority of study participants indicated an interest in using digital games to deliver content or facilitate learning. Results of the study also revealed Northern Minnesota teachers perceived numerous benefits to using digital games in the classroom.

The implications of this study suggest Northern Minnesota teachers would be encouraged to use DGBL in the classroom if they received professional development aligned to DGBL. Additionally, results of the study suggest Northern Minnesota teachers would benefit from technology support personnel to provide training and ongoing support and mentor or peer teachers to provide ongoing support related to DGBL. Study participants also indicated the following supports would encourage their use of DGBL: (a) time to explore and plan for implementation of digital games; (b) pre-made lesson plans aligned to the specific content area and grade levels; and (c) additional funding to purchase games, licenses, and/or equipment.

References

Alves Fernandes, L. M., Cruz Matos, G., Azevedo, D., Rodrigues Nunes, R., Paredes, H., Morgado, L., Barbosa, L. F., Martins, P., Fonseca, B., Cristóvão, P., de Carvalho, F., & Cardoso, B. (2016). Exploring educational immersive videogames: An empirical study with a 3D multimodal interaction prototype. *Behaviour & Information Technology, 35*(11), 907–918. https://doi.org/10.1080/0144929X.2016.1232754

An, Y. (2018). The effects of an online professional development course on teachers' perceptions, attitudes, self-efficacy, and behavioral intentions regarding digital game-based learning. *Educational Technology Research and Development*, *66*(6), 1505-1527. https://doi.org/10.1007/s11423-018-9620-z

Anderson, M., & Jiang, J. (2018). *Teens, social media & technology 2018*. Pew Research Center. https://www.pewresearch.org/internet/2018/05/31/teens-social-media-technology-2018/

Angeli, C. (2005). Transforming a teacher education method course through technology: Effects on preservice teachers' technology competency. *Computers and Education, 45*(4), 383–398. https://doi.org/10.1016/j.compedu.2004.06.002

Apperley, T. (2009). *A rough history of online gaming*. [PowerPoint Slides]. Academia. https://www.academia.edu/1677895/A_Rough_History_of_MMOs

Atwood, B. (1995, May 13). That's edutainment: Software developers provide education and entertainment for young minds. *Billboard*. 91-94. https://books.google.com/books?id=vAsEAAAAMBAJ&pg=PA91&hl=en#v=onepage&q&f=false

Avedon, E. M., & Sutton-Smith, B. (1979). *The study of games*. Huntington, R. E. Krieger Pub. Co.

Baek, Y. (2008). What hinders teachers in using computer and video games in the classroom? Exploring factors inhibiting the uptake of computer and video games. *CyberPsychology & Behavior*, *11*(6), 665–671. https://doi.org/10.1089/cpb.2008.0127

BBC. (2009, 24 December). *The history of Royal Ashbourne Shrovetide Football*. https://web.archive.org/web/20100820061721/http://news.bbc.co.uk/local/derby/hi/people_and_places/history/newsid_8322000/8322713.stm

Beard, C. (2018). Dewey in the World of Experiential Education. *New Directions for Adult & Continuing Education, 2018*(158), 27–37. https://doi.org/10.1002/ace.20276

Becker, K. (2007). Digital game-based learning once removed: Teaching teachers. *British Journal of Educational Technology*, *38*(3), 478–488. https://doi.org/10.1111/j.1467-8535.2007.00711.x

Becker, K., & Parker, J. (2014). An overview of game design techniques. In K. S. Shrier (Ed.), *Learning, education & games volume one* (pp. 179-198). ETC Press.

Bickhard, M. K. (1992). How does the environment affect the person? In L. T. Winegar & J. Valsiner. (Eds.), *Children's development within social contexts: Metatheoretical, theoretical and methodological issues* (pp. 63-92). Lawrence Erlbaum Associates.

Bloom, G. (2018). *Gaming the stage: Playable media and the rise of English commercial theater*. University of Michigan Press. http://www.jstor.org/stable/j.ctv3mt93h

Bouchard, R. P. (2017, July 23). I designed the Oregon Trail, you have died of dysentery. *Format.com*. https://www.format.com/magazine/features/design/you-have-died-of-dysentery-oregon-trail-design

Bowman Jr., R. F. (1982). A "Pac-Man" theory of motivation: Tactical implications for classroom instruction. *Educational Technology*, *22*(9), 14–16.

Boyle, E., Connolly, T. M., & Hainey, T. (2011). The role of psychology in understanding the impact of computer games. *Entertainment Computing*, *2*(2), 69–74. https://doi.org/10.1016/j.entcom.2010.12.002

Bruckman, A. (1999, March 17). *Can educational be fun?* [Paper Presentation]. Game Developer's Conference. San Jose, CA, United States.

Burke, A. (2010). Teacher as leader in a “flat world”: Preparing students in a global community. *Language Arts Journal of Michigan*, *25*(2), Article 4. http://scholarworks.gvsu.edu/lajm/vol25/iss2/4

Chaiklin, S. (2003). The zone of proximal development in Vygotsky's analysis of learning and instruction. In A. Kozulin, B. Gindis, V. S. Ageyev, & S. M. Miller (Eds.), *Learning in doing. Vygotsky's educational theory in cultural context* (pp. 39–64). Cambridge University Press. https://doi.org/10.1017/CBO9780511840975.004

Chang, C., Liang, C., Chou, P., & Lin, G. (2017). Is game-based learning better in flow experience and various types of cognitive load than non-game-based learning? Perspective from multimedia and media richness. *Computers in Human Behavior, 71*, 218–227. https://doi.org/10.1016/j.chb.2017.01.031

Chang, J., & Bushman, B. (2019). Effect of exposure to gun violence in video games on children’s dangerous behavior with real guns: A randomized clinical trial. *JAMA Network Open*, *2*(5), 1-11. https://doi.org/10.1001/jamanetworkopen.2019.4319

Chmiel, M. (2015). Game-Based Learning (GBL). Research Starters: Education (Online Edition).

Chou, C., & Tsai, M. (2007). Gender differences in Taiwan high school students’ computer game playing. *Computers in Human Behavior*, *23*(1), 812-824. doi:10.1016/j.chb.2004.11.011

Chou, J. (2017, December 19). *Actionable gamification: Octalysis framework*. Jeffrey Chou. https://medium.com/@chow0531/actionable-gamification-fbe27f6cb2d6

Chuang, T.Y., & Chen, W.F. (2009). Effect of computer-based video games on children: An experimental study. *Journal of Educational Technology & Society*, *12*(2), 1-10.

Clancey, W. J. (1995) A tutorial on situated learning. In T.-W. Chan & J. Self (Eds.), *Emerging computer technologies in education: Selected papers of the International Conference on Computers and Education (Taiwan),* pp. 49-70. Charlottesville, VA: AACE.

Compaine, B. (1983). The new literacy. *Daedalus*, *112*(1), 129-142. https://www.jstor.org/stable/20024839?seq=1

Corbett, S. (2010, September 15). Learning by playing: Video games in the classroom. *The New York Times Magazine*. https://www.nytimes.com/2010/09/19/magazine/19video-t.html

Corona, F., Cozzarelli, C., Palumbo, C., & Sibilio, M. (2013). Information technology and edutainment: Education and entertainment in the age of interactivity. *International Journal of Digital Literacy and Digital Competence (IJDLDC)*, *4*(1), 12–18. https://doi.org/10.4018/jdldc.2013010102

Coventry, J. (2007). Educational computing for the masses. *SiliconUser*. Archived from the original on June 28, 2007. Retrieved August 24, 2020, from https://archive.is/20070628002639/http://siliconuser.com/?q=node/12

Cowan, J. (2008). Strategies for planning technology-enhanced learning experiences. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, *82*(2), 55–59. https://doi.org/10.3200/TCHS.82.2.55-59

Cox, B. D. (2018) The Place for Dewey's Constructivism of Intelligent Action in the American Meritocracy of Thorndike. In D. Kritt. (Ed.), *Constructivist Education in an Age of Accountability*. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-319-66050-9_2

CSPAN. (1993, December 9). *Congressional hearing: Video game violence* [Video]. CSPAN. https://www.c-span.org/video/?52848-1/video-game-violence

Craddock, D. L. (2017, September 15). *The making of Carmen San Diego*. Kotaku.com. https://kotaku.com/the-making-of-carmen-sandiego-1804490410

Crocco, F. (2011). Critical gaming pedagogy. *The Radical Teacher*, (91), 26-41. doi:10.5406/radicalteacher.91.0026

Csikszentmihalyi, M. (2008). *Flow: The psychology of optimal experience*. Harper Perennial Classics Ed.

Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). *Effective teacher professional development*. Palo Alto, CA: Learning Policy Institute. https://learningpolicyinstitute.org/sites/default/files/product-files/Effective_Teacher_Professional_Development_REPORT.pdf de Byl, P. (2013). Factors at play in tertiary curriculum gamification. *International Journal of Game-Based Learning*, *3*(2), 1–21. https://doi.org/10.4018/ijgbl.2013040101

De Grove, F., Bourgonjon, J., & Van Looy, J. (2012). Digital games in the classroom? A contextual approach to teachers' adoption intention of digital games in formal education. *Computers in Human Behavior*, *28*(6), 2023–2033. https://doi.org/10.1016/j.chb.2012.05.021

Dede, C. (2009). Immersive interfaces for engagement and learning. *Science*, *323*(5910), 66–69. https://doi.org/10.1126/science.1167311

Denham, A. (2019). Using the PCaRD digital game-based learning model of instruction in the middle school mathematics classroom: A case study. *British Journal of Educational Technology*, *50*(1), 415–427. https://doi.org/10.1111/bjet.12582

Dickey, M. (2006a). Game design and learning: A conjectural analysis of how massively multiple online role-playing games (MMORPGs) foster intrinsic motivation. *Educational Technology Research and Development*, *55*(3), 253–273. https://doi.org/10.1007/s11423-006-9004-7

Dickey, M. (2006b). Game design narrative for learning: Appropriating adventure game design narrative devices and techniques for the design of interactive learning environments. *Educational Technology Research and Development*, *54*(3), 245-263. http://www.jstor.org/stable/30221219

Domínguez, S. (2013). Gamifying learning experiences: Practical implications and outcomes. *Computers and Education*, *63*, 380–392. https://doi.org/10.1016/j.compedu.2012.12.020

Egenfeldt-Nielsen, S. (2005). *Beyond edutainment: Exploring the educational potential of computer games.* [Doctoral Dissertation, IT University of Copenhagen]. Research Gate. https://www.researchgate.net/publication/245584260_Beyond_Edutainment_Exploring_the_Educational_Potential_of_Computer_Games

Egenfeldt-Nielsen, S. (2006). Overview of research on the educational use of video games. *Nordic Journal of Digital Literacy*, *1*. https://www.idunn.no/dk/2006/03/overview_of_research_on_the_educationaluseof_video_games

Entertainment Software Association. (2020). *The ESA's 2020 essential facts about the video game industry*. https://www.theesa.com/esa-research/2020-essential-facts-about-the-video-game-industry/

Ervin, A. (2017). *Bit by bit: How video games transformed our world*. Basic Books.

ESRB. (n.d). *Our history*. ESRB. https://www.esrb.org/history/

Eyisi, D. (2016). The usefulness of qualitative and quantitative approaches and methods in researching problem-solving ability in science education curriculum. *Journal of Education and Practice*, *7*(15), 91–100. https://eric.ed.gov/?id=EJ1103224

Farner, S. (2019, August 23). *How many people still play World of Warcraft?* SVG. https://www.svg.com/163310/how-many-people-still-play-world-of-warcraft/

Ferguson, C. J., & Wang, J. C. K. (2019). Aggressive video games are not a risk factor for future aggression in youth: A longitudinal study. *Journal of Youth & Adolescence*, *48*(8), 1439–1451. https://doi-org.bsuproxy.mnpals.net/10.1007/s10964-019-01069-0

Freire, P. (2005). *Pedagogy of the oppressed*. The Continuum International Publishing Group, Inc.

Fullerton, T., Swain, C., & Hoffman, S. (2008). *Game design workshop: A playcentric approach to creating innovative games*. Elsevier Morgan Kaufmann.

Gard, T. (2010 May 7). *Action adventure level design: Kung Fu Zombie Killer*. Gamastura. https://www.gamasutra.com/view/feature/4413/action_adventure_level_design_.php

Gardner, M. R., & Elliott, J. B. (2014). The immersive education laboratory: Understanding affordances, structuring experiences, and creating constructivist, collaborative processes, in mixed-reality smart environments. *EAI Endorsed Transactions on Future Intelligent Educational Environments, 1*(1), e6. https://doi.org/10.4108/fiee.1.1.e6

Gee, J., Hull, G., & Lankshear, C. (1996). *The new work order: Behind the language of the new capitalism*. Westview Press.

Gee, J. P. (2003). *What video games have to teach us about learning and literacy?* Palgrave Macmillan.

Gee, J. P., & Shaffer, D. W. (2010). *Looking where the light is bad: Video games and the future of assessment* (Epistemic Games Group Working Paper No. 2010-02). Madison: University of Wisconsin-Madison.

Gee, J. P. (2013). *The anti-education era: Creating smarter students through digital learning*. Palgrave Macmillan.

Gershenfeld, A. (2014). Mind games. *Scientific American, 310*(2), 54-59. https://doi-org.bsuproxy.mnpals.net/10.1038/scientificamerican0214-54

Ginsburg, K. R. (2007). The importance of play in promoting healthy child development and maintaining strong parent-child bonds. *Pediatrics*, *119*, 182-191.

Granic, I., Lobel, A., & Engels, R. C. M. E. (2014). The benefits of playing video games. *The American Psychologist*, *69*(1), 66-78. https://doi.org/10.1037/a0034857

Greenfield, P. M. (2014). *Mind and media: The effects of television, video games, and computers*. Psychology Press.

Groff, J. S. (2018). The potentials of game-based environments for integrated, immersive learning data. *European Journal of Education*, *53*(2), 188-201. https://doi.org/10.1111/ejed.12270

Groff, J. S., Cranmer, S., & Howells, C. (2010). *The impact of console games in the classroom: Evidence from schools in Scotland*. Futurelab. https://www.nfer.ac.uk/publications/futl25/futl25.pdf

Groff, J., McCall, J., Darvasi, P., & Gilbert, Z. (2016). Using games in the classroom. In K. S. Shrier (Ed.), *Learning, education & games volume two: Bringing games into educational contexts* (pp. 19-41). ETC Press.

Grunwald Associates LLC. (2010). *Educators, technology and 21st Century skills: Dispelling five myths.* The Richard W. Riley College of Education and Leadership: Walden University. https://www.waldenu.edu/-/media/Walden/general-media/about-walden/colleges-and-schools/riley-college-of-education/educational-research/full-report-dispelling-five-myths.pdf?la=en

Hamari, J., Koivisto, J., & Sarsa, H. (2014, January 7-10). *Does gamification work? A literature review of empirical studies on gamification.* 47th Hawaii international conference on system sciences (HICSS). IEEE. doi:10.1109/HICSS.2014.377

Harris, B. J. (2014). *Console wars: Sega, Nintendo, and the battle that defined a generation*. It Books, an imprint of William Morrow Publishers.

Harvard News Editor. (2010, September 24). *Remembering Professor, Emeritus, Gerald Lesser*. Harvard Graduate School of Education. https://www.gse.harvard.edu/news/10/09/remembering-professor-emeritus-gerald-lesser

Hennessey, J., McGowan, J., & Orzechowski, T. (2017). *The comic book story of video games: The incredible history of the electronic gaming revolution*. Ten Speed Press.

Hmelo-Silver,C. E. (2004). Problem-based learning: What and how do students learn? *Educational Psychology Review, 16*(3), 235-266.

Hogle, J. G. (1996). *Considering games as cognitive tools: In search of "edutainment"*. https://files.eric.ed.gov/fulltext/ED425737.pdf

Huizenga, J. C., ten Dam, G. T. M., Voogt, J. M., & Admiraal, W. F. (2017). Teacher perceptions of the value of game-based learning in secondary education. *Computers & Education*, *110*. pp. 105-115. doi:10.1016/j.compedu.2017.03.008

ICRC. (2018). Review article: The current state of virtual reality on behavior change. *Innovation Unit Extended Reality & Behavior Change Series*. https://blogs.icrc.org/inspired/wp-content/uploads/sites/107/2019/10/Article-Review-VR-and-Behavior-Change.pdf

Indvik, L. (2012). *The fascinating history of online role-playing games*. Mashable. https://mashable.com/2012/11/14/mmorpgs-history/

JFFLabs. (2020 January). *2020 immersive learning technology*. https://www.jff.org/what-we-do/impact-stories/jfflabs-acceleration/2020-immersive-learning-technology/

Jong, M. S. Y. & Shang, J., & Lee, J. H. M. (2019). *Constructivist learning through computer gaming*. https://pdfs.semanticscholar.org/8f11/66a15994db49831cb46f7bbfd32d92616d91.pdf

Joyce, A., Gerhard, P., & Derby, M. (2009). *How are digital games used in schools? Complete results of the study*. European Schoolnet. http://games.eun.org/upload/gis-full_report_en.pdf

June, L. (2013, January 16). *For amusement only: The life and death of the American arcade*. The Verge. https://www.theverge.com/2013/1/16/3740422/the-life-and-death-of-the-american-arcade-for-amusement-only

Kafai, Y. B. (2006). Playing and making games for learning: Instructionist and constructionist perspectives for game studies. *Games and Culture: A Journal of Interactive Media*, *1*(1), 36-40. doi:10.1177/1555412005281767

Kapp, K. (2014). Gamification: Separating fact from fiction. *Chief Learning Officer*, *13*(3), 45-52. https://www.chieflearningofficer.com/2014/03/19/gamification-separating-fact-from-fiction/#:~:text=Simply%2C%20gamification%20is%20an%20emergent,mechanics%20and%20game%2Dbased%20thinking

Karagiorgas, D. N., & Niemann, S. (2017). Gamification and game-based learning. *Journal of Educational Technology Systems*, *45*(4), pp. 499-519. doi:10.1177/0047239516665105

Katsaliaki, K., & Mustafee, N. (2015). Edutainment for sustainable development: A survey of games in the field. *Simulation & Gaming*, *46*(6), 647–672. https://doi.org/10.1177/1046878114552166

Ke, F. (2008). Computer games application within alternative classroom goal structures: Cognitive, metacognitive, and affective evaluation. *Educational Technology Research and Development*, *56*(5/6), 539-556. http://www.jstor.org/stable/25619945

Ke, F. (2009). A qualitative meta-analysis of computer games as learning tools. In Ferdig, R. E. (Ed.), *Handbook of Research on Effective Electronic Gaming in Education* (pp. 1-32). IGI Global. http://doi:10.4018/978-1-59904-808-6.ch001

Kenny, R., & McDaniel, R. (2011). The role teachers' expectations and value assessments of video tames play in their adoption and integrating them into their classrooms. *British Journal of Educational Technology*, *42*(2), 197-213. https://doi.org/10.1111/j.1467-8535.2009.01007.x

Kent, S. (2001). *The ultimate history of video games: From Pong to Pokémon and beyond--the story behind the craze that touched our lives and changed the world*. Prima.

Ketelhut, D., & Schifter, C. (2011). Teachers and game-based learning: Improving understanding of how to increase efficacy of adoption. *Computers and Education*, *56*(2), 539–546. https://doi.org/10.1016/j.compedu.2010.10.002

Keyes, C. L. M. (2001, January 24). *Ask an expert: What is 'positive psychology'?* CNN. http://www.cnn.com/2001/fyi/teachers.tools/01/24/c.keyes/index.html

Kim, B., Park, H., & Baek, Y. (2009). Not just fun, but serious strategies: Using meta-cognitive strategies in game-based learning. *Computer & Education*. *52*(4), pp. 800-810. https://doi.org/10.1016/j.compedu.2008.12.004

Kirriemuir, J., & McFarlane, A. (2004). *Report 8: Literature review in games and learning*. FutureLab. https://telearn.archives-ouvertes.fr/hal-00190453/document

Kocurek, C. A. (2015). *Coin-operated Americans: Rebooting boyhood at the video game arcade.* University of Minnesota Press.

Koerper, H. C., & Whitney-Desautels, N. A. (1999). Astragalus bones: Artifacts or ecofacts? *Pacific Coast Archaeological Social Quarterly, 35*(2-3). http://www.pcas.org/vol35n23/3523koerper.pdf

Kolb, David. (2015). *Experiential learning: Experience as the source of learning and development*. Pearson Education, Inc.

Kritt, D.W. (2018). *Constructivist education in an age of accountability*. Palgrave Macmillan, Cham. DOI: 10.1007/978-3-319-66050-9_1.

Kulman, R., Slobuski, T., & Seitsinger, R. (2014). Teaching 21st Century, executive-functioning, and creativity skills with popular video games and apps. In K. S. Schrier (Ed.*), Learning, Education & Games, 1*. (pp. 159-174). ETC Press.

Kuss, D. J., Louws, J., & Wiers, R. W. W. (2012). Online gaming addiction? Motives predict addictive play behavior in massively multiplayer online role-playing games. *Cyberpsychology, Behavior & Social Networking*, *15*(9), 480-485. https://doi.org/10.1089/cyber.2012.0034

Kwon, C. (2019). Verification of the possibility and effectiveness of experiential learning using HMD-based immersive VR technologies. *Virtual Reality, 23*, 101–118 (2019). https://doi.org/10.1007/s10055-018-0364-1

Landers, R. N. (2015). Developing a theory of gamified learning: Linking serious games and gamification of learning. *Simulation & Gaming*, *45*(6), 752-768. doi:10.1177/1046878114563660

Larsen, R. (2017, February 27). Shrovetide football: What is the history behind the famous game? *University of Derby Blog*. https://blog.derby.ac.uk/2017/02/shrovetide-football-history-behind-famous-game/

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge University Press.

Lei, J. (2009). Digital natives as preservice teachers: What technology preparation is needed? *Journal of Computing in Teacher Education, 25*(3), 87-97.

Lesser, G. (1972). Learning, teaching, and television production for children: The experience of Sesame Street. *Harvard Educational Review*, *42*(2), 232–272. https://doi.org/10.17763/haer.42.2.h13nq18915q61rw6

Levy, F., & Murnane, R. J. (2004). *The new division of labor: How computers are creating the next job market*. Princeton University Press.

Li, L., Worch, E., Zhou, Y., & Aguiton, R. (2015). How and why digital generation teachers use technology in the classroom: An explanatory sequential mixed methods study. *International Journal for the Scholarship of Teaching and Learning*, *9*(2). https://doi.org/10.20429/ijsotl.2015.090209

Liao, C. (2019). The interactivity of video and collaboration for learning achievement, intrinsic motivation, cognitive load, and behavior patterns in a digital game-based learning environment. *Computers and Education, 133*, 43–55. https://doi.org/10.1016/j.compedu.2019.01.013

Linowes, J. (2020). *Unity 2020 virtual reality projects: Learn VR development by building immersive applications and games with Unity 2019.4 and later versions*. Pact Publishing.

Lobel, A., Engels, R., Stone, L., Burk, W., & Granic, I. (2017). Video gaming and children's psychosocial wellbeing: A longitudinal study. *Journal of Youth and Adolescence, 46*(4), 884–897.

Lourenço, O. (2014). Piaget, Jean. *In Encyclopedia of educational theory and philosophy* (Vol. 2, pp. 623–628). SAGE Reference.

Lu, S.-J., & Liu, Y.-C. (2015). Integrating augmented reality technology to enhance children's learning in marine education. *Environmental Education Research, 21*(4), 525–541. https://doi-org.bsuproxy.mnpals.net/10.1080/13504622.2014.911247

Madden, J., Pandita, S., Schuldt, J., Kim, B., S. Won, A., & Holmes, N. (2020). Ready student one: Exploring the predictors of student learning in virtual reality. *PloS One, 15*(3). https://doi.org/10.1371/journal.pone.0229788

Malone, T., & Lepper, M. (1987). Making learning fun: A taxonomy of intrinsic motivations for learning. In R. Snow & M. Farr (Eds.), *Aptitude, learning, and instruction: Vol. 3* (pp. 223-253). Earlbaum.

Malykhina, E. (2014, September 12). Fact or fiction? Video games are the future of education. *Scientific American*. http://www.scientificamerican.com/article/fact-or-fiction-video-games-are-the-future-of-education/

Mayer, R. E. (2014). *Computer Games for Learning*. The MIT Press.

McClarty, K. L., Orr, A., Frey, P. M., Dolan, R. P., Vassileva, V. & McVay, A. (2012). *A literature review of gaming in education*. Pearson. https://images.pearsonassessments.com/images/tmrs/Lit_Review_of_Gaming_in_Education.pdf

McCormick, T. (2013). Anthropology of an idea: Gamification. *Foreign Policy*, (201), 26-27. http://www.jstor.org/stable/24575963

McGonigal, J. (2011). *Reality is broken: Why games make us better and how they can change the world*. Penguin Press.

Meredith, T. R. (2016). Game-based learning in professional development for practicing educators: A review of the literature. *TechTrends: Linking Research and Practice to Improve Learning*, *60*(5), 496-502.

Merkel, L., & Sanford, K. (2011). Complexities of gaming cultures: Adolescent gamers adapting and transforming learning. *E-Learning and Digital Media*, *8*(4), pp. 397-407. doi:10.2304/elea.2011.8.4.397

Mills, K., & Unsworth, L. (2017, December 19). Multimodal literacy. *Oxford Research Encyclopedia of Education.* Oxford University Press. https://oxfordre.com/education/view/10.1093/acrefore/9780190264093.001.0001/acrefore-9780190264093-e-232

Millstone, J. (2012). *Teacher attitudes about digital games in the classroom* [PowerPoint slides]. The Joan Ganz Cooney Center at Sesame Street. http://joanganzcooneycenter.org/wp-content/uploads/2012/07/jgcc_teacher_survey1.pdf

Mishra, P., Foster, A. N. (2007). The claims of games: A comprehensive review and directions for future research. In R. Carlsen, K. McFerrin, J. Price, R. Weber & D.A. Willis (Eds.), *Society for Information Technology & Teacher Education: 2007 18th International Conference*. San Antonio, Texas, Association for the Advancement of Computing in Education (AACE).

Monem, R. (2015). Metacognition and self-scaffolding in MMORPGs: Case study of an adolescent male gamer. *The Qualitative Report*, *20*(4), Article 5. https://nsuworks.nova.edu/cgi/viewcontent.cgi?article=2121&context=tqr

Montiel, I., Delgado-Ceballos, J., Ortiz-de-Mandojana, N., & Antolin-Lopez, R. (2020). New ways of teaching: Using technology and mobile apps to educate on societal grand challenges. *Journal of Business Ethics*, *161*(2), 243–251. https://doi.org/10.1007/s10551-019-04184-x

Morris, N. (2012). *Learning and teaching with emerging technologies: Preservice pedagogy and classroom realities*. [Master's Thesis, University of Windsor]. University of Windsor Electronic Theses and Dissertations. https://scholar.uwindsor.ca/etd/249

Mughal, F. & Zafar, A. (2011). Experiential learning from a constructivist perspective: Reconceptualizing the Kolbian Cycle. *International Journal of Learning & Development*, *1*(2), 27-37. https://doi.org/10.5296/ijld.v1i2.1179

Nguyen, L. (26 July 2017). 15 people who have died while playing video games. TheGamer.com. https://www.thegamer.com/15-people-who-have-died-playing-video-games/

Nino, M., & Evans, M. A. (July 2014). *Lessons learned using video games in the constructivist undergraduate engineering classroom*. Conference: 12th annual Latin American and Caribbean consortium of engineering educations conference: At: Guayaquil, Ecuador.

NPR Staff. (2015, June 19). *Q&A: Shigeru Miyamoto on the origins of Nintendo's famous characters*. NPR. Retrieved August 13, 2020, from https://www.npr.org/sections/alltechconsidered/2015/06/19/415568892/q-a-shigeru-miyamoto-on-the-origins-of-nintendos-famous-characters

Nyitray, K. J. (2019). Game on to game after: Sources for video game history. *Reference & User Services Quarterly, 59*(1), 7–11.

Otting H., & Zwaal W. (2007). *The identification of constructivist pedagogy in different learning environments*. In M. K. McCuddy, H. van den Bosch, W. B. Martz, A. V. Matveev, & K. O. Morse (Eds.), *The Challenges of Educating People to Lead in a Challenging World.* Educational Innovation in Economics and Business, Vol. 10. Springer, Dordrecht. https://doi.org/10.1007/978-1-4020-5612-3_9

Palmer, J. A. (2001). *Fifty major thinkings on education: From Confucius to Dewey*. Routledge.

Patton, R. (2013). Games as an artistic medium: Investigating complexity thinking in game-based art pedagogy. *Studies in Art Education, 55*(1), 35–50. https://doi.org/10.1080/00393541.2013.11518915

Pavlas, D., Heyne, K., Bedwell, W., Lazzara, E., & Salas, E. (2010). *Game-based Learning: The impact of flow state and videogame self-efficacy*. Proceedings of The Human Factors and Ergonomics Society Annual Meeting, 54(28), 2398.

Perrotta, C., Featherstone, G., Aston, H., & Houghton, E. (2013). *Game-based learning: Latest evidence and future directions* (NFER Research Programme: Innovation in Education). Slough: NFER. https://www.nfer.ac.uk/publications/GAME01/GAME01.pdf

Plass, J. L., Homer, B. D., & Kinzer, C. K. (2016). Foundations of game-based learning. *Educational Psychologist*, *50*(4), 258–283. https://doi.org/10.1080/00461520.2015.1122533

Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon*, *9*(5). 1-6. https://doi.org/10.1108/10748120110424816

Prensky, M. (2007). *Digital game-based learning*. St. Paul, MN: Paragon House Edition.

Pressey, B. (2013). *Comparative analysis of national teacher surveys*. New York: The Joan Ganz Cooney Center at Sesame Workshop.

Project Tomorrow®. (2016). *From print to pixel: The role of videos, games, animations and simulations within K-12 education*. Speak Up 2015 National Findings. In Project Tomorrow. https://tomorrow.org/speakup/pdfs/SU15AnnualReport.pdf

Pursell, C. W. (2015). *From playgrounds to PlayStation*. Johns Hopkins University Press.

Q2L. (2020). *About Q2L*. Retrieved August 19, 2020, from https://www.q2l.org/about/

Radoff, J. (2010, May 24). History of social games. *Jon Radoff's Internet Wonderland.* https://web.archive.org/web/20100527090108/http://radoff.com/blog/2010/05/24/history-social-games/

Rawitsch, D., Gilbert, L., Schilling, S., Palmquist, M., LaFrenz, D., & Bouchard, R. (2019). *Collection: Minnesota Educational Computing Corporation (MECC) collection: The Strong*. http://archives.museumofplay.org/repositories/3/resources/113

Reimer, M. (2013). Tell me how to get to Sesame Street. *Jeunesse, Young People, Texts, Cultures, 5*(1), 1–15. https://doi.org/10.1353/jeu.2013.0002

Rich, P., & Reeves, T. (2006). John Dewey: A significant contributor to the field of educational technology. *Educational Technology, 46*(4), 54-56. http://www.jstor.org/stable/44429318

Richard, G. T. (2014). Designing for the audience: Past practice and inclusive considerations. In Schrier, K. (Ed.), *Learning, education, & games volume one*. (pp. 199-223). ETC Press.

Roberts, C. M. (2010). *The dissertation journey: A practical guide to planning, writing, and defending your dissertation* (2nd ed.). Corwin, A SAGE Company. http://dx.doi.org/10.4135/9781452219219

Robinson, K. (2006, February). *Do schools kill creativity?* [Video]. TED Conferences. https://www.ted.com/talks/sir_ken_robinson_do_schools_kill_creativity?language=en

Rogers, F., & Sharapan, H. B. (1994). How children use “play.” *The Education Digest, 59*(8), 13–. Retrieved from https://search.proquest.com/docview/1942572164

Rosen, L. D. (2011). Teaching the iGeneration. *Educational Leadership, 68*(5), 10–15.

Rutherford, T., Long, J., & Farkas, G. (2017). Teacher value for professional development, self-efficacy, and student outcomes within a digital mathematics intervention. *Contemporary Educational Psychology, 51*, 22–36. https://doi.org/10.1016/j.cedpsych.2017.05.005

Salen, K., Torres, R., Wolozin, L., Rufo-Tepper, R., & Shapiro, A. (2011). *Quest to Learn: Developing the school for digital kids*. The John D. and Catherine T. MacArthur

Foundation Reports on Digital Media and Learning. https://clalliance.org/wp-content/uploads/2020/03/Quest-To-Learn-Developing-School-for-Digital-Kids.pdf

Salen, K., & Zimmerman, E. (2004). *Rules of play: Game design fundamentals*. USA: MIT.

Salen Tekinbaş, K. (2020). *Quest to Learn*. Katie Salen Tekinbaş. https://www.katiesalen.me/quest-to-learn

Samsung Electronics America. (2015, June 23). *Survey finds majority of teachers do not feel prepared to use technology in classrooms*. https://news.samsung.com/us/survey-finds-majority-of-teachers-do-not-feel-prepared-to-use-technology-in-classrooms/

SAS Institute, Inc. (n.d.) *Analytics, artificial intelligence and data management*. https://www.sas.com/en_us/home.html

Schrier, K. (2014). *Learning, education and games. Volume one: Curricular and design considerations* (Version 1). Carnegie Mellon University. https://doi.org/10.1184/R1/6686825.v1

Schwartz, K. (2014, November 24). *Some struggles teachers face using games in the classroom*. Mind/Shift. https://ww2.kqed.org/mindshift/2014/11/24/some-struggles-teachers-face-using-games-in-the-classroom/

Shaffer, D. W. (2006). *How computer games help children learn*. Palgrave Macmillan.

Shaffer, D. W., Squire, K. R., Halverson, R., & Gee, J. P. (2005). Video games and the future of learning. *The Phi Delta Kappan, 87*(2), pp. 104-111.

Shao, R., & Wang, Y. (2019). The relation of violent video games to adolescent aggression: An examination of moderated mediation effect. *Frontiers in Psychology,* 1-9. https://doi.org/10.3389/fpsyg.2019.00384

Shatto, B., & Erwin, K. (2016). Moving on from Millennials: Preparing for Generation Z. *Journal of Continuing Education in Nursing, 47*(6), 253–254. https://doi.org/10.3928/00220124-20160518-05

Shute, V. J. (2007). Tensions, trends, tools, and technologies: Time for an educational sea change. In C. A. Dwyer (Ed.), *The future of assessment: Shaping teaching and learning* (pp. 139–187). Lawrence Erlbaum/Taylor & Francis.

Shute, V. J., & Ke, F. (2012). Games, learning, and assessment. In D. Ifenthaler, D. Eseryel, & X. Ge (Eds.), *Assessment in game-based learning* (pp. 43-58). Springer.

SIIA. (2009). *Best practices for using games & simulations in the classroom: Guidelines for K-12 educators*. A publication of the Software & Information Industry Association (SIIA) Education Division. http://www.siia.net/Portals/0/pdf/games_final.pdf

Smith, S. (2017). Stepping out of the classroom into virtuality: Using MMORPGs to teach history. *Teaching History (Emporia, Kan.), 42*(2), 73–82. https://doi.org/10.33043/TH.42.2.73-82

Southall, S. (2012). *Digital native preservice teachers: An examination of their self-efficacy beliefs regarding technology integration in classroom settings.* VCU Scholars Compass.

Squire, K., & Jenkins, H. (2003). Harnessing the power of games in education. *Insight, 3*(1), 5-33.

Stapleton, L., & Stefaniak, J. (2019). Cognitive constructivism: Revisiting Jerome Bruner's influence on instructional design practices. *TechTrends, 63*(1), 4–5. https://doi.org/10.1007/s11528-018-0356-8

Stieler-Hunt, C., & Jones, C. (2015). Educators who believe: Understanding the enthusiasm of teachers who use digital games in the classroom. *Research in Learning Technology, 23,* 1–14. https://doi.org/10.3402/rlt.v23.26155

Stieler-Hunt, C., & Jones, C. (2019). A professional development model to facilitate teacher adoption of interactive, immersive digital games for classroom learning. *British Journal of Educational Technology*, *50*(1), 264–279. https://doi.org/10.1111/bjet.12679

Stuart, K. (2010, August 10). *What do we mean when we call a game 'immersive'?*. The Guardian. https://www.theguardian.com/technology/gamesblog/2010/aug/10/games-science-of-immersion

SuperData, A Nielsen Company. (2020). *2019 year in review: Digital games and interactive media.* https://www.superdataresearch.com/reports

SuperData, A Nielsen Company. (2021). *2020 year in review: Digital games and interactive media*. https://www.superdataresearch.com/reports

Swanzen, R. (2018). Facing the generation chasm: The parenting and teaching of Generations Y and Z. *International Journal of Child, Youth and Family Studies IJCYFS, 9*(2), 125–150. https://doi.org/10.18357/ijcyfs92201818216

Sweller, J. (2010). Element interactivity and intrinsic, extraneous, and germane cognitive load. *Educational Psychology Review, 22*(2), 123–138. https://doi.org/10.1007/s10648-010-9128-5

Takeuchi, L. M., & Vaala, S. (2014). *Level up learning: A national survey on teaching with digital games*. New York: The Joan Ganz Cooney Center at Sesame Workshop.

https://www.joanganzcooneycenter.org/wp-content/uploads/2014/10/jgcc_leveluplearning_final.pdf

Thorsteinsson, E. & Davey, L. (2014). Adolescents' compulsive internet use and depression: A longitudinal study. *Open Journal of Depression, 3,* 13-17. doi: 10.4236/ojd.2014.31005.

Tobias, S., Fletcher, J. D., & Wind, A. P. (2014). Game-based learning. In. D. H. Jonassen (Ed.), *Handbook of Research on Educational Communications and Technology*, 485–503.

Tsai, F., Tsai, C., & Lin, K. (2015). The evaluation of different gaming modes and feedback types on game-based formative assessment in an online learning environment. *Computers & Education, 81*, 259-269. doi:10.1016/j.compedu.2014.10.013

University College Dublin (UCD). (n.d.). *Education theory: Constructivism and social constructivism.* Open Educational Resources of UCD Teaching and Learning, University College Dublin. http://www.ucdoer.ie/index.php/Education_Theory/Constructivism_and_Social_Constructivism

United Nations Human Rights: Office of the High Commissioner. (1989). *Convention on the rights of the child*. General Assembly Resolution 44/25. https://www.ohchr.org/en/professionalinterest/pages/crc.aspx

Van Eck, R. (2009). A guide to integrating COTS games into your classroom. In R. E. Ferdig (Ed.), *Handbook of Research on Effective Electronic Gaming in Education* (pp. 179-199). IGI Global. http://doi:10.4018/978-1-59904-808-6.ch011

Van Eck, R. (2011, March 10) *The gaming of educational transformation TEDxManitoba* [Video]. TED Conferences. http://youtu.be/khJDLo0oMX4

Vygotsky, L. S. (1967). Play and its role in the mental development of the child. *Soviet Psychology, 5*(3), 6-18, https://doi.org/10.2753/RPO1061-040505036

Wagner, C., & Ip, R. (2009). Action learning with Second Life: A pilot study. *Journal of Information Systems Education, 20*(2), 249–258.

Waterfield, J. (2018). Convenience sampling. In B. Frey (Ed.), *The SAGE encyclopedia of educational research, measurement, and evaluation* (Vol. 1, pp. 403-403). Thousand Oaks, CA: SAGE Publications, Inc. https://dx.doi.org/10.4135/9781506326139.n155

Weitze, C. B. (2014). Developing goals and objectives for gameplay and learning. In K. S. Shrier (Ed.), *Learning, education & games volume one*. (pp. 225-249). ETC Press.

Wouters, P., van Nimwegen, C., van Oostendorp, H., & van der Spek, E. D. (2013). A meta-analysis of the cognitive and motivational effects of serious games. *Journal of Educational Psychology*, *105*(2), 249-265.

Wu, M. L. (2015). *Teachers' experience, attitudes, self-efficacy and perceived barriers to the use of digital game-based learning: A survey study through the lens of a typology of educational digital games*. [Doctoral Dissertation, Michigan State University]. MSU Libraries Digital Repository. https://doi.org/doi:10.25335/M5GX2G

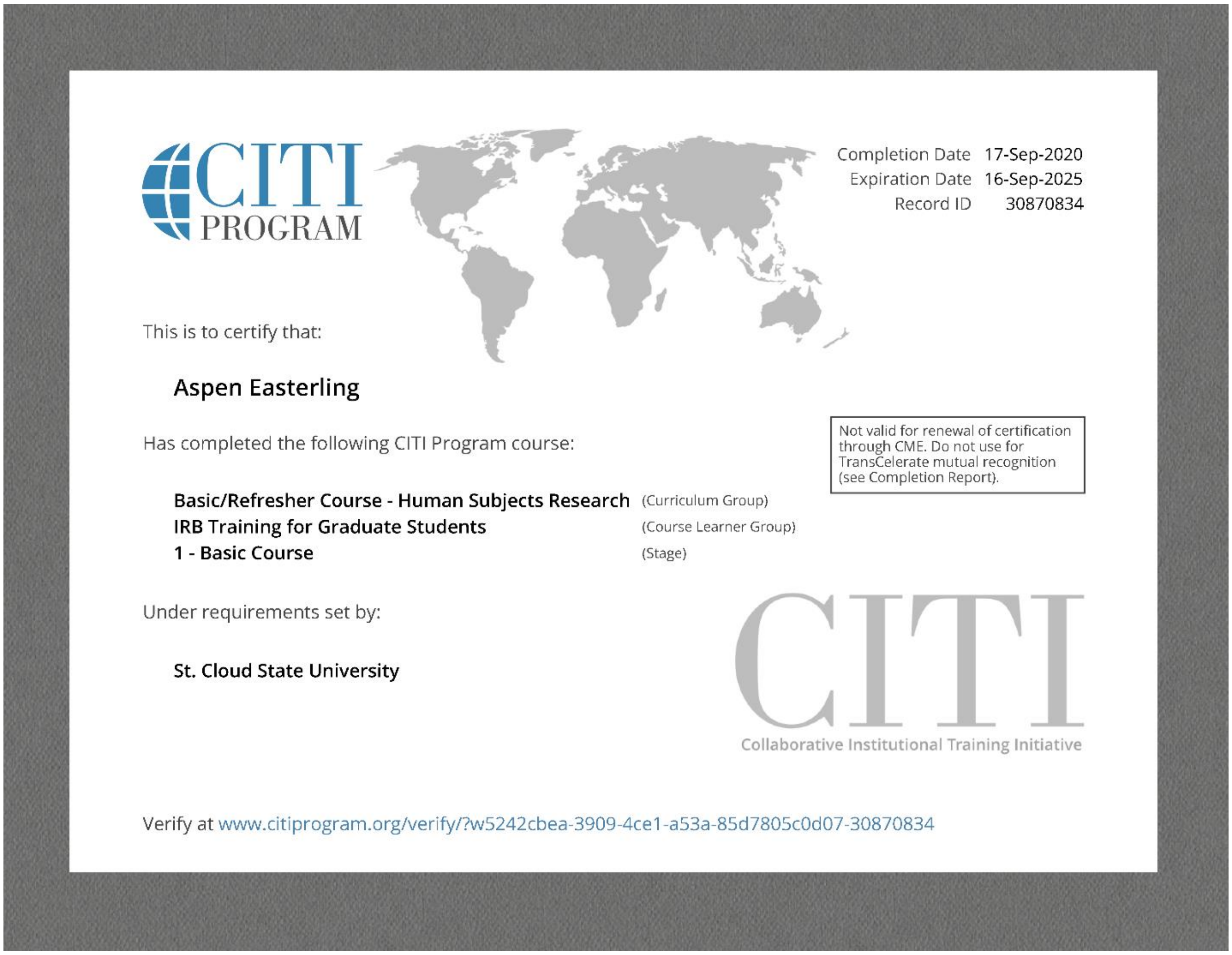
Young, M., Schrader, P., Zheng, D. (2006). MMOGs as learning environments: An ecological journey into Quest Atlantis and The Sims Online. *Innovate 2*(4).

Yu, X. (2010, September 28). 'Sesame Street' legend Gerald Lesser dies at 84. *The Harvard Crimson*. https://www.thecrimson.com/article/2010/9/28/lesser-school-ed-sesame/

Ziechermann, G., & Cunningham, C. (2011). *Gamification by design: Implementing game mechanics in web and mobile apps.* O'Reilly Media, Inc.

Zyda, M. (2005). From visual simulation to virtual reality to games. *Computer*, *38*(9), 25–32. https://doi.org/10.1109/MC.2005.297

Appendix A: CITI Program Certificate



CITI PROGRAM

Completion Date 17-Sep-2020
Expiration Date 16-Sep-2025
Record ID 30870834

This is to certify that:

Aspen Easterling

Has completed the following CITI Program course:

Not valid for renewal of certification through CME. Do not use for TransCelerate mutual recognition (see Completion Report).

Basic/Refresher Course - Human Subjects Research (Curriculum Group)
IRB Training for Graduate Students (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

St. Cloud State University

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?w5242cbea-3909-4ce1-a53a-85d7805c0d07-30870834

Appendix B: Request for Superintendent Support Email

DATE

Dear Superintendent _______________,

My name is Aspen Easterling and I am a doctoral candidate at St. Cloud State University. The focus of my dissertation study is teacher training and perceptions related to digital game-based learning.

I am asking for your support to distribute a Qualtrics survey, Teacher Training and Perceptions Related to Digital Game-Based Learning, to the P-12 classroom teachers in the _______ School District.

The 10-question survey is expected to take approximately 8 minutes to complete and teacher participation is voluntary and anonymous. The decision to participate will not affect current or future relations with the school, school district, St. Cloud State University, or the researcher. Teachers may choose not to participate in the study and/or if they decide to participate, they are free to withdraw at any time without penalty. Data from the survey will be presented and reported in aggregated form. Personal, school, and school district information will not be identified in any manner. Minimal or no risks and discomforts to participants are anticipated and there are no personal or professional risks in participating. To request a copy of the results of the study, please contact the primary investigator.

If you grant your support for the study, a link to the electronic survey will be emailed to your districts' principals to distribute to the P-12 teachers. The survey will be open between November 16 and December 11, 2020.

Please reply to this email to let me know if you would like to provide support for the study.

Thank you for your time and consideration.

Aspen Easterling
St. Cloud State University Doctoral Candidate
Bemidji State University Licensure Certification Officer

Primary investigator, Aspen Easterling, can be contacted at aleasterling@stcloudstate.edu

Faculty advisor, Dr. David Lund, can be contacted at dlund1@stcloudstate.edu

Appendix C: Initial Principal Email

DATE

Dear Principal _______________,

Your superintendent, _____________, has granted support (attached) to distribute a survey to the P-12 teachers in the _________ School District.

The 10-question survey, Teacher Training and Perceptions Related to Digital Game-Based Learning, is expected to take approximately 8 minutes to complete.

The decision to participate will not affect current or future relations with the school, school district, St. Cloud State University, or the researcher. Teachers may choose not to participate in the study and/or if they decide to participate, they are free to withdraw at any time without penalty. Data from the survey will be presented and reported in aggregated form. Personal, school, and school district information will not be identified in any manner. Minimal or no risks and discomforts to participants are anticipated and there are no personal or professional risks in participating. To request a copy of the results of the study, please contact the primary investigator.

I will send you the survey link, to forward to P-12 teachers, on Monday, November 16, 2020.

If you have any questions about this research study please contact the primary investigator, Aspen Easterling, and/or the faculty advisor, Dr. David Lund.

Thank you for your time.

Aspen Easterling
St. Cloud State University Doctoral Candidate
Bemidji State University Teacher Licensure Certification Officer

Primary investigator, Aspen Easterling, can be contacted at aleasterling@stcloudstate.edu

Faculty advisor, Dr. David Lund, can be contacted at dlund1@stcloudstate.edu

Appendix D: Request to Distribute Survey Link Principal Email

DATE

Dear Principal _______________,

Your superintendent, _____________, has granted support (attached) to distribute a survey to the P-12 teachers in the __________ School District.

Below is a link to the survey: Teacher Training and Perceptions Related to Digital Game-Based Learning. The 10-question survey is expected to take approximately 8 minutes to complete and teacher participation is voluntary and anonymous.

The decision to participate will not affect current or future relations with the school, school district, St. Cloud State University, or the researcher. Teachers may choose not to participate in the study and/or if they decide to participate, they are free to withdraw at any time without penalty. Data from the survey will be presented and reported in aggregated form. Personal, school, and school district information will not be identified in any manner. Minimal or no risks and discomforts to participants are anticipated and there are no personal or professional risks in participating. To request a copy of the results of the study, please contact the primary investigator.

Please share the following link with your P-12 teachers:

LINK

The survey will close on Friday, December 11, 2020, at 5:00 pm. Two reminder emails will be sent, the first reminder will be sent on Tuesday, December 1, 2020, and the final reminder will be sent on Wednesday, December 9, 2020.

If you have any questions about this research study please contact the primary investigator, Aspen Easterling, and/or the faculty advisor, Dr. David Lund.

Thank you for your time.

Aspen Easterling
St. Cloud State University Doctoral Candidate
Bemidji State University Teacher Licensure Certification Officer

Primary investigator, Aspen Easterling, can be contacted at aleasterling@stcloudstate.edu

Faculty advisor, Dr. David Lund, can be contacted at dlund1@stcloudstate.edu

Appendix E: Request to Distribute Survey Link Principal Email – Reminder One

Dear Principal _______________,

Your superintendent, _____________, has granted support (attached) to distribute a survey to the P-12 teachers in the __________ School District.

Below is a link to the survey: Teacher Training and Perceptions Related to Digital Game-Based Learning. The 10-question survey is expected to take approximately 8 minutes to complete and teacher participation is voluntary and anonymous.

The decision to participate will not affect current or future relations with the school, school district, St. Cloud State University, or the researcher. Teachers may choose not to participate in the study and/or if they decide to participate, they are free to withdraw at any time without penalty. Data from the survey will be presented and reported in aggregated form. Personal, school, and school district information will not be identified in any manner. Minimal or no risks and discomforts to participants are anticipated and there are no personal or professional risks in participating. To request a copy of the results of the study, please contact the primary investigator.

Please share the following link with your P-12 teachers:

LINK

The survey will close on Friday, December 11, 2020, at 5:00 pm. This is the first of two reminder emails, a final reminder email will be sent on Wednesday, December 9, 2020.

If you have any questions about this research study please contact the primary investigator, Aspen Easterling, and/or the faculty advisor, Dr. David Lund.

Thank you for your time.

Aspen Easterling
St. Cloud State University Doctoral Candidate
Bemidji State University Teacher Licensure Certification Officer

Primary investigator, Aspen Easterling, can be contacted at aleasterling@stcloudstate.edu

Faculty advisor, Dr. David Lund, can be contacted at dlund1@stcloudstate.edu

Appendix F: Request to Distribute Survey Link Principal Email – Final Reminder

DATE

Dear Principal _______________,

Your superintendent, _____________, has granted support (attached) to distribute a survey to the P-12 teachers in the ____________ School District.

Below is a link to the survey: Teacher Training and Perceptions Related to Digital Game-Based Learning. The 10-question survey is expected to take approximately 8 minutes to complete and teacher participation is voluntary and anonymous.

The decision to participate will not affect current or future relations with the school, school district, St. Cloud State University, or the researcher. Teachers may choose not to participate in the study and/or if they decide to participate, they are free to withdraw at any time without penalty. Data from the survey will be presented and reported in aggregated form. Personal, school, and school district information will not be identified in any manner. Minimal or no risks and discomforts to participants are anticipated and there are no personal or professional risks in participating. To request a copy of the results of the study, please contact the primary investigator.

Please share the following link with your P-12 teachers:

LINK

The survey will close this Friday, December 11, 2020, at 5:00 pm. This is the final reminder email.

If you have any questions about this research study please contact the primary investigator, Aspen Easterling, and/or the faculty advisor, Dr. David Lund.

Thank you for your time.

Aspen Easterling
St. Cloud State University Doctoral Candidate
Bemidji State University Teacher Licensure Certification Officer

Primary investigator, Aspen Easterling, can be contacted at aleasterling@stcloudstate.edu

Faculty advisor, Dr. David Lund, can be contacted at dlund1@stcloudstate.edu

Appendix G: Survey Instrument

Dear Teacher**,**

You are invited to participate in a research study examining teacher training and perceptions related to digital game-based learning in P-12 schools. The purpose of this research is to determine current professional development practices related to digital game-based learning (see definition below), as well as perceived benefits and barriers to digital game-based learning.

As a part of this study, you will be asked to complete a 10-question survey: **Teacher Training and Perceptions Related to Digital Game-Based Learning**. The survey is expected to take approximately 8 minutes to complete and will be anonymous.

Consent to Participate

The decision to participate will not affect current or future relations with the school, school district, St. Cloud State University, or the researcher. You may choose not to participate in the study and/or if you decide to participate, you are free to withdraw at any time without penalty. Data from the survey will be presented and reported in aggregated form. Personal, school, and school district information will not be identified in any manner. Minimal or no risks and discomforts to participants are anticipated and there are no personal or professional risks in participating.

If you have questions about this research study, you may contact the primary investigator, Aspen Easterling at aleasterling@stcloudstate.edu and/or the faculty advisor, Dr. David Lund at dlund1@stcloudstate.edu. To request a copy of the results of the study, please contact the primary investigator.

By completing the following 10 questions, you are consenting to participate in the study.

Thank you for your time,

Aspen Easterling

Teacher Training and Perceptions Related to Digital Game-Based Learning

Survey Instrument

Definition of Terms:

- *Digital Games:* electronic games played on consoles (e.g., PlayStation, Nintendo, Xbox), desktop computers, laptop computers, portable devices (e.g., iPads, Chromebooks, smartphones), or using immersive learning technologies such as augmented reality or virtual reality (e.g., Google Cardboard, Oculus, HTC VIVE, Merge Cube, Microsoft HoloLens)
- *Digital Game-Based Learning:* use of digital games to combine elements of play with educational content to facilitate learning

1. **What grade range best reflects your current teaching grade level(s)? Select all that apply.**
    - Preschool (Ages 3-4)
    - Early Childhood (Birth – Grade 3)
    - Elementary (K-5)
    - Middle School (5-8)
    - Combined Middle School and High School (7-12)
    - High School (9-12)
    - K-12 or P-12
    - ALC or Other Mixed Ages
    - Other (please specify)

2. **What is your area of specialization? Select all that apply.**
    - Agricultural Education
    - Business Education
    - Career and Technical Education (CTE)

- Communication Arts and Literature
- Computer, Keyboarding, and Related Technology
- Developmental and Adaptive Physical Education (DAPE)
- Early Childhood Education
- Elementary Education
- English as a Second Language (ESL)
- Family and Consumer Sciences (FACS)
- Gifted and Talented
- Health Education
- Industrial Technology
- Library Media Specialist
- Mathematics
- Music Education (e.g., Classroom, Instrumental, Vocal)
- Physical Education
- Preschool
- Reading
- Science Education (e.g., Chemistry, Earth & Space, General Science, Life Science, Physics)
- Social Studies
- Speech/Theater
- Special Education (ABS, ASD, EBD, ECSE, LD)
- Visual Arts
- World Language and Cultures (e.g., Chinese, French, German, Spanish)
- Other (please specify)

3. How long have you been teaching? Select the appropriate answer.

   a. 0 – 4 years
   b. 5 or more years

4. **I have experience using the following devices to deliver educational content or to facilitate learning. Select all that apply.**
    a. Desktop or Laptop Computer
    b. Document Camera (e.g., Elmo)
    c. Gaming Console (e.g., PlayStation, Nintendo, Xbox)
    d. Interactive Whiteboard (e.g., SMART Board, Promethean)
    e. Overhead Projector
    f. Smartphone (e.g., Android, iOS, Windows)
    g. Tablet (e.g., iPad, Chromebook, Microsoft Surface Go)
    h. Virtual Reality or Augmented Reality (e.g., Google Cardboard, Oculus, HTC VIVE, Merge Cube, Microsoft HoloLens)
    i. None of the above
    j. Other (please specify)

Num.	Question/Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
5.	**Please rate the following statements.**					
	I have experience using a digital game to deliver educational content or facilitate learning					
	I strive to incorporate new digital technologies into my teaching practice					
	I am interested in using digital games to deliver educational content or facilitate learning					

Num.	Question/Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
6.	**To what extent do you agree with the following statements?**					
	Digital games can be useful tools to deliver educational content or facilitate learning					
	Digital games provide ongoing challenges for students					

	Digital games promote the use of problem-solving skills					
	Digital games provide hands-on learning opportunities for students					
	Digital games provide dynamic learning opportunities					
	Digital games promote experimental learning					
	Digital games provide instantaneous feedback to learners					
	Digital games provide ongoing feedback to learners					
	Digital games can promote personalized learning					
	Digital games can promote learning in STEM (Science, Technology, Engineering, Mathematics) fields					
	Digital games provide me with a strong platform to engage my students					
	Digital games can be used to promote learning objectives to meet Minnesota standards					
	Digital games can be used to promote learning objectives to meet Common Core standards					
	Digital games can be used as supplemental learning activities					
	Digital games promote collaborative learning					
	Digital games can be used as a reward for students					
	Digital games provide opportunities for students to make connections and to apply what they are learning					
	Digital games provide safe environments in which students are able to fail without fear of consequences					
	Digital games provide opportunities to learn from mistakes					
	Digital games promote inquiry					

	Digital games promote creativity					
	Students are motivated by digital games					
	Students are more accustomed to learning with digital technologies					
	Students are more accustomed to learning with other technologies (outside of digital games)					
	Using digital games helps me relate to my students					

Num.	**Question/Statement**	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
7.	**To what extent do the following factors deter you from using digital games to deliver educational content or facilitate learning in your classroom?**					
	Cost of purchasing games and/or licenses					
	Cost of equipment (e.g., game consoles, computers, tablets, etc.)					
	Fellow teachers' negative perceptions of using digital games as educational tools					
	Parents' negative perceptions of using digital games as educational tools					
	Administrators' negative perceptions of using digital games as educational tools					
	Lack of administrative support to use digital games for teaching					
	Digital games cause classroom management issues					
	Technology distracts students from meeting learning goals					
	Inadequate technology support to run digital games in the classroom					
	Playing digital games has a negative influence on students					
	Violence in video games is a deterrent					
	Short class periods hinder the use of digital games					

	Digital game-based learning cannot meet desired learning outcomes					
	Lack of teacher training on the use of digital games during teacher preparation program					
	Lack of professional development on the use of digital games					
	Lack of alignment with curriculum or state standards					
	Lack of training to make informed choices regarding selection of digital games					
	Digital games require additional lesson planning time					
	Other (please specify)					

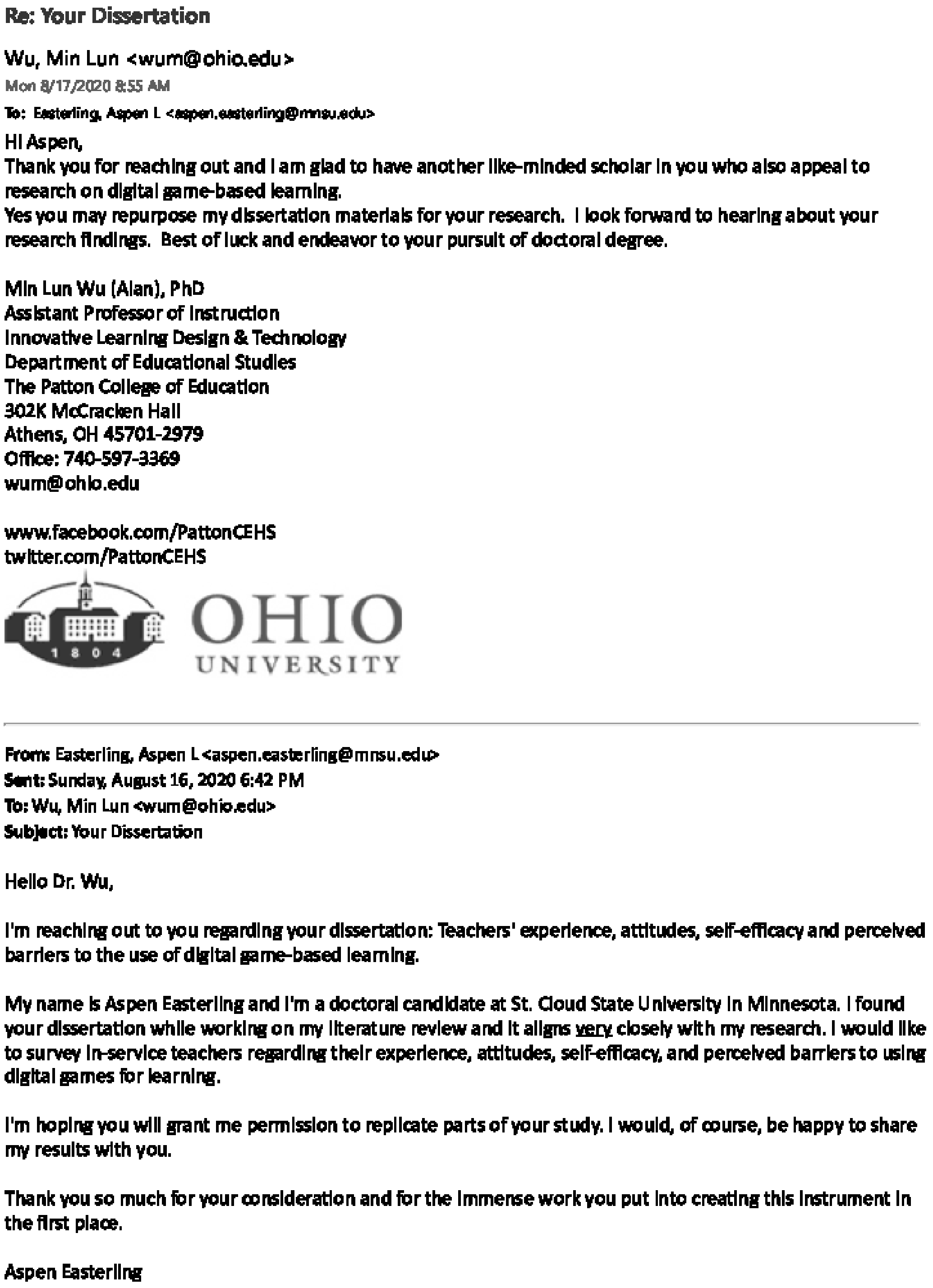
Num.	**Question/Statement**	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
8.	**To what extent have you received training or professional development related to the use of digital game-based learning?**					
	Digital game-based learning was discussed during my preservice teacher preparation program					
	Digital game-based learning was covered in-depth during my preservice teacher preparation program					
	Digital game-based learning has been covered during professional development sessions provided by the school district					
	A mentor or peer teacher encouraged me to use digital games					
	A district technology support person encouraged me to use digital games					
	I sought out training or experimented with the use of digital games on my own					
	Other (please specify)					

Num.	Question/Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
9.	**To what extent would the following training options encourage you to use digital games to deliver educational content or facilitate learning in your classroom?**					
	Professional development provided by the school district					
	Online training options					
	Summer training options					
	Weekend training options					
	Coursework provided by a college or university					
	A mentor or peer teacher to provide ongoing support					
	Technology support personnel to provide ongoing support					
	I have no plans to use digital games in my classroom					
	Other (please specify)					

Num.	Question/Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
10.	**To what extent would the following support options encourage you to use digital games to deliver educational content or facilitate learning in your classroom?**					
	Additional funding to purchase equipment					
	Additional funding to purchase games and/or licenses					
	Administrator support					
	Improved perceptions of fellow teachers					
	Improved perceptions of administrators					
	Improved perceptions of parents					
	Time to explore and plan for digital game implementation					

	Pre-made lesson plans aligned to specific content area and grade level					
	Other (please specify)					

Appendix H: Permission to Repurpose Existing Survey Instrument



Re: Your Dissertation

Wu, Min Lun <wum@ohio.edu>
Mon 8/17/2020 8:55 AM
To: Easterling, Aspen L <aspen.easterling@mnsu.edu>

Hi Aspen,
Thank you for reaching out and I am glad to have another like-minded scholar in you who also appeal to research on digital game-based learning.
Yes you may repurpose my dissertation materials for your research. I look forward to hearing about your research findings. Best of luck and endeavor to your pursuit of doctoral degree.

Min Lun Wu (Alan), PhD
Assistant Professor of Instruction
Innovative Learning Design & Technology
Department of Educational Studies
The Patton College of Education
302K McCracken Hall
Athens, OH 45701-2979
Office: 740-597-3369
wum@ohio.edu

www.facebook.com/PattonCEHS
twitter.com/PattonCEHS

OHIO
UNIVERSITY

From: Easterling, Aspen L <aspen.easterling@mnsu.edu>
Sent: Sunday, August 16, 2020 6:42 PM
To: Wu, Min Lun <wum@ohio.edu>
Subject: Your Dissertation

Hello Dr. Wu,

I'm reaching out to you regarding your dissertation: Teachers' experience, attitudes, self-efficacy and perceived barriers to the use of digital game-based learning.

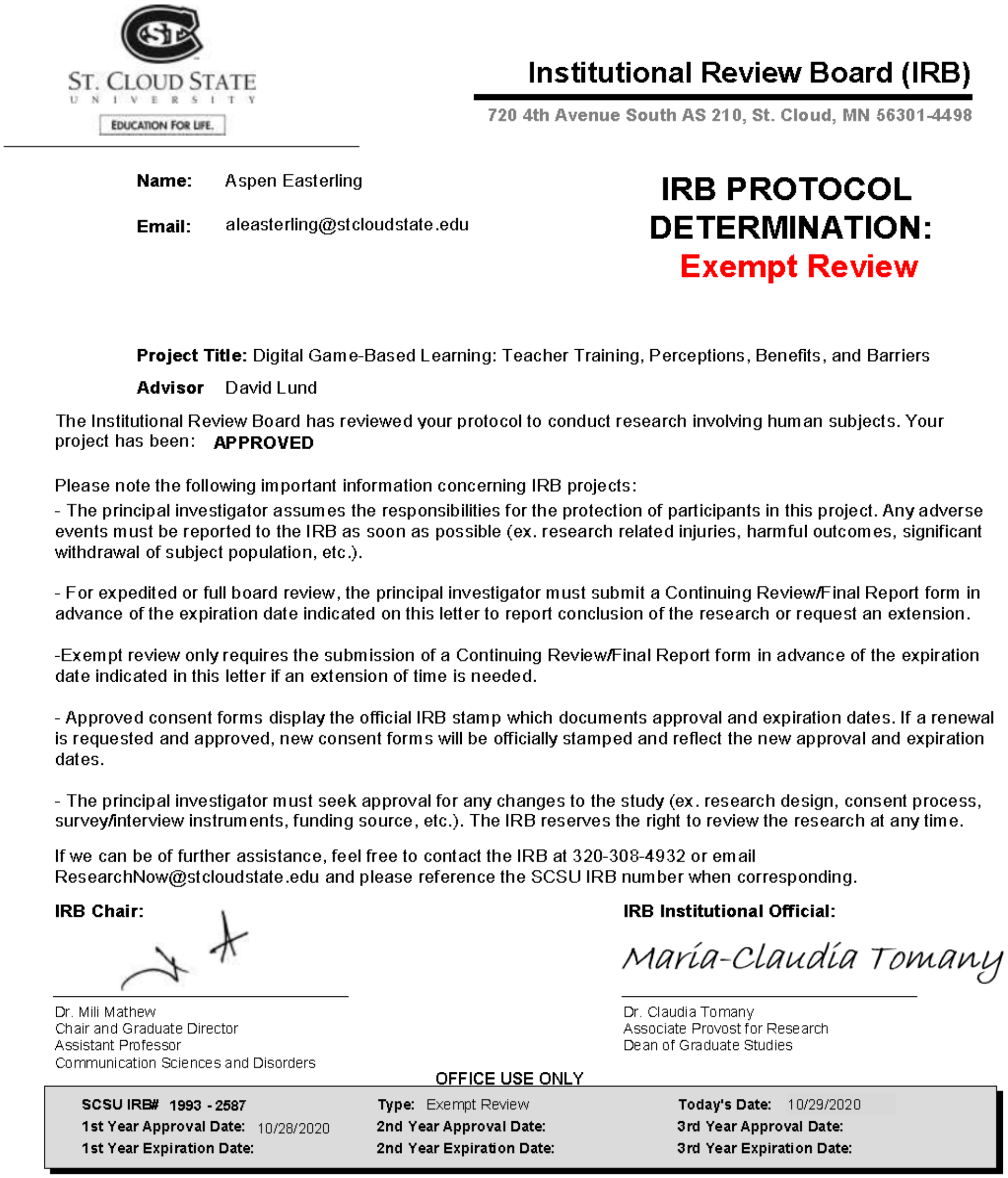
My name is Aspen Easterling and I'm a doctoral candidate at St. Cloud State University in Minnesota. I found your dissertation while working on my literature review and it aligns very closely with my research. I would like to survey in-service teachers regarding their experience, attitudes, self-efficacy, and perceived barriers to using digital games for learning.

I'm hoping you will grant me permission to replicate parts of your study. I would, of course, be happy to share my results with you.

Thank you so much for your consideration and for the immense work you put into creating this instrument in the first place.

Aspen Easterling

Appendix I: Institutional Review Board (IRB) Approval



ST. CLOUD STATE
UNIVERSITY
EDUCATION FOR LIFE.

Institutional Review Board (IRB)
720 4th Avenue South AS 210, St. Cloud, MN 56301-4498

Name: Aspen Easterling

Email: aleasterling@stcloudstate.edu

IRB PROTOCOL DETERMINATION:
Exempt Review

Project Title: Digital Game-Based Learning: Teacher Training, Perceptions, Benefits, and Barriers

Advisor David Lund

The Institutional Review Board has reviewed your protocol to conduct research involving human subjects. Your project has been: **APPROVED**

Please note the following important information concerning IRB projects:
- The principal investigator assumes the responsibilities for the protection of participants in this project. Any adverse events must be reported to the IRB as soon as possible (ex. research related injuries, harmful outcomes, significant withdrawal of subject population, etc.).

- For expedited or full board review, the principal investigator must submit a Continuing Review/Final Report form in advance of the expiration date indicated on this letter to report conclusion of the research or request an extension.

-Exempt review only requires the submission of a Continuing Review/Final Report form in advance of the expiration date indicated in this letter if an extension of time is needed.

- Approved consent forms display the official IRB stamp which documents approval and expiration dates. If a renewal is requested and approved, new consent forms will be officially stamped and reflect the new approval and expiration dates.

- The principal investigator must seek approval for any changes to the study (ex. research design, consent process, survey/interview instruments, funding source, etc.). The IRB reserves the right to review the research at any time.

If we can be of further assistance, feel free to contact the IRB at 320-308-4932 or email ResearchNow@stcloudstate.edu and please reference the SCSU IRB number when corresponding.

IRB Chair:

Dr. Mili Mathew
Chair and Graduate Director
Assistant Professor
Communication Sciences and Disorders

IRB Institutional Official:

María-Claudia Tomany

Dr. Claudia Tomany
Associate Provost for Research
Dean of Graduate Studies

OFFICE USE ONLY

SCSU IRB# 1993 - 2587	**Type:** Exempt Review	**Today's Date:** 10/29/2020
1st Year Approval Date: 10/28/2020	**2nd Year Approval Date:**	**3rd Year Approval Date:**
1st Year Expiration Date:	**2nd Year Expiration Date:**	**3rd Year Expiration Date:**

Appendix J: Reliability Results

Question 6 (7_1 through 7_25) Reliability

Case Processing Summary

		N	%
Cases	Valid	325	94.2
	Excluded[a]	20	5.8
	Total	345	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.941	25

Question 7 (8_1 through 8_16) Reliability

Case Processing Summary

		N	%
Cases	Valid	321	93.0
	Excluded[a]	24	7.0
	Total	345	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.840	18

Question 8 (9_1 through 9_7) Reliability

Case Processing Summary

		N	%
Cases	Valid	36	10.4
	Excluded[a]	309	89.6
	Total	345	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.890	7

Question 9 (10_1 through 10_9) Reliability

Case Processing Summary

		N	%
Cases	Valid	32	9.3
	Excluded[a]	313	90.7
	Total	345	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.960	9

Question 10 (11_1 through 11_8) Reliability

Case Processing Summary

		N	%
Cases	Valid	331	95.9
	Excluded[a]	14	4.1
	Total	345	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.745	8

Combined Overall Reliability Questions 6-10 (7_1 through 11_8)

Case Processing Summary

		N	%
Cases	Valid	21	6.1
	Excluded[a]	324	93.9
	Total	345	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.915	67

Appendix K: Validity Results

Convergent Validity Overall (Combined Score Q6, Q7, Q8, Q9, and Q10 and Q6_1, Q6_2, Q6_3)

Significant inter-item correlations between the items/survey questions indicate that the questions demonstrate convergent validity.

Correlations

		Question6	Question7	Question8	Question9	Question10
Question6	Pearson Correlation	1	-.122*	.161**	.501**	.334**
	Sig. (2-tailed)		.024	.003	.000	.000
	N	343	341	339	341	340
Question7	Pearson Correlation	-.122*	1	-.096	.269**	.122*
	Sig. (2-tailed)	.024		.077	.000	.024
	N	341	341	338	340	339
Question8	Pearson Correlation	.161**	-.096	1	.162**	.120*
	Sig. (2-tailed)	.003	.077		.003	.027
	N	339	338	339	339	338
Question9	Pearson Correlation	.501**	.269**	.162**	1	.484**
	Sig. (2-tailed)	.000	.000	.003		.000
	N	341	340	339	341	340
Question10	Pearson Correlation	.334**	.122*	.120*	.484**	1
	Sig. (2-tailed)	.000	.024	.027	.000	
	N	340	339	338	340	340
Q6_1	Pearson Correlation	.260**	-.158**	.353**	.211**	.160**
	Sig. (2-tailed)	.000	.003	.000	.000	.003
	N	343	341	339	341	340
Q6_2	Pearson Correlation	.402**	.005	.141**	.294**	.251**

	Sig. (2-tailed)	.000	.932	.009	.000	.000
	N	342	340	338	340	339
Q6_3	Pearson Correlation	.621**	-.025	.169**	.546**	.408**
	Sig. (2-tailed)	.000	.643	.002	.000	.000
	N	343	341	339	341	340

Correlations

		Q6_1	Q6_2	Q6_3
Question6	Pearson Correlation	.260**	.402**	.621**
	Sig. (2-tailed)	.000	.000	.000
	N	343	342	343
Question7	Pearson Correlation	-.158**	.005	-.025
	Sig. (2-tailed)	.003	.932	.643
	N	341	340	341
Question8	Pearson Correlation	.353**	.141**	.169**
	Sig. (2-tailed)	.000	.009	.002
	N	339	338	339
Question9	Pearson Correlation	.211**	.294**	.546**
	Sig. (2-tailed)	.000	.000	.000
	N	341	340	341
Question10	Pearson Correlation	.160**	.251**	.408**
	Sig. (2-tailed)	.003	.000	.000
	N	340	339	340
Q6_1	Pearson Correlation	1	.245**	.397**

	Sig. (2-tailed)		.000	.000
	N	345	344	345
Q6_2	Pearson Correlation	.245**	1	.496**
	Sig. (2-tailed)	.000		.000
	N	344	344	344
Q6_3	Pearson Correlation	.397**	.496**	1
	Sig. (2-tailed)	.000	.000	
	N	345	344	345

*. Correlation is significant at the 0.05 level (2-tailed).

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