EXPLORING ELEMENTARY STUDENT MOTIVATION LEVELS WITHIN GAMIFIED DIGITAL MATHEMATICS INSTRUCTIONAL PROGRAMS

by

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Dedication

This dissertation is dedicated foremost to my Savior, Jesus Christ. My hope and delight are in Him, and He has given me the passion to pursue my dreams. Secondly, this work is dedicated to my loving husband, Clint, and our three incredible children, Ryleigh, Kevin, and Averie, who tirelessly supported "mommy" while she worked.

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So many individuals have impacted this journey; it would take an entire book to recognize them all. Passion is defined as “an irrational but irresistible motive for a belief or action” (Vocabulary.com Dictionary, n.d., para. 6). In education we engage in lifelong learning entirely on the basis of our passion. A doctoral program, with the years of effort it requires, is irrational. With the support of my family, work family, friends, and dissertation committee, this passion has become truly irresistible. Thank you to every person who has offered a word of encouragement, given feedback, or just commiserated with me. Thanks to you, my irrational but irresistible passion has become a reality.

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Abstract

Some approaches to teaching mathematics have led to decreased student motivation. Gamification is an application of game elements within nongame settings. While gamification may increase motivation in other contexts, its effective use in digital mathematics instruction to motivate elementary students is undetermined. Based on the constructs of self-determination theory (i.e., autonomy, relatedness/recognition, competence/self-efficacy), intrinsic and extrinsic motivation were the two determinants used to develop research questions and frame the study. The purpose of this qualitative study was to identify how intrinsic and extrinsic motivators embedded within gamified digital mathematics instructional programs contribute to motivation levels of third- through fifth-grade students at an elementary school located in central Texas. A target research sample that consisted of 38 participants was identified which then produced a data producing sample of 20 participants. Semi-scripted phenomenological interviews were conducted. Data were analyzed by each research question to identify the degree to which gamified components, across nine different subtypes (interest/enjoyment, perceived competence, effort/importance, perceived choice, value/usefulness, intrinsic motivation, external regulation, introjected regulation, and identified regulation), impacted student motivation. This study concluded that students reported the highest motivation levels with a combination of intrinsic and extrinsic gamified motivators. Data suggested that a lack of autonomy established by mandatory participation in digital mathematics instructional programs positively impact motivation. Future research could address the impact of gamification upon levels of motivation by age or grade level and how levels of motivation change over time.

Chapter 1: Introduction

In moving learning and instruction to a more digital format, developers of instructional programs seek to identify and develop gamified delivery platforms based on relevant learning and behavioral theories to motivate and engage students (Hamari & Koivisto, 2015; Hamari, Koivisto, & Sarsa, 2014; Raymer, 2011). Such instructional programs should be able to address a variety of settings, including primary instruction, supplemental instruction, remedial instruction, or independent practice (Drickey, 2006). One strategy to increase student motivation is the integration of gamification elements within instruction (Johnson, Onwuegbuzie, & Turner, 2007), and many gamified programs already exist to address a variety of instructional needs. Web-based instructional mathematics programs such as ReflexMath (Cholmsky, 2011) and Imagine Math (formerly Think Through Math; Smolensky, 2015) use a gamified delivery system to motivate, instruct, assess, differentiate, remediate, and accelerate student learning. Student engagement tracking and reporting are available through gamified programs such as ClassDojo.com, which uses a gamified tracking program to record student behavior and to communicate that behavior to parents (Klein, 2013). Programs with embedded gamified elements, such as avatars, role-playing, points, and leaderboards (Johnson et al., 2013), have application in professional development settings with websites such as SimSchool.org that simulate classroom environments by creating a virtual classroom (Knezek, Christensen, Tyler-Wood, Fisser, & Gibson, 2012). Such an alternate reality has proven useful for developing classroom management skills in particularly preservice educators (Knezek et al., 2012).

Focusing on the role gamification may play in increasing student motivation during mathematics instruction, this chapter sets the context for the study by reviewing active learning, technology integration, and elementary-level gamified mathematics instructional programs as the

context for the study. Gamified mathematics instructional programs have been developed to address instructional needs of students (Cholmsky, 2011; Johnson et al., 2013; Smolensky, 2015) but the impact of these programs upon elementary students' levels of motivation has not been explored. The purpose of this qualitative study was to identify how intrinsic and extrinsic motivators embedded within gamified digital mathematics instructional programs contribute to motivation levels of third- through fifth-grade students at an elementary school located in central Texas.

The findings of this study serve to deepen understanding of the degree to which gamified elements embedded within digital mathematics instructional programs contribute to student motivation. Ultimately, this deeper understanding of the connection between gamification and motivation will assist digital program developers and educators in designing high interest, engaging, and motivating gamified programs. The ultimate goal of developing more motivating programs would be to increase student learning and achievement (Reeve & Lee, 2014). Chapter 1 will discuss the background and contextualization of the issue before identifying the problem statement and purpose statement. An overview of the theoretical framework and methodology guiding the study will be discussed which will then frame the research questions. Assumptions made by the researcher as well as delimitations and limitations of the study will be clearly stated. Chapter 1 will include a discussion regarding the significance of the study. Then, the definition of terms used by the study will be presented. Finally, this chapter will discuss the organization of the study before summarizing the alignment among all components presented.

Background and Contextualization of the Issue

Gamification is a practice with roots throughout many cultures (Seaborn & Fels, 2015). Werhach and Hunter (2012) defined gamification as game components "embedded into activities

that are not themselves a game" (p. 27). Gamification can be digital or nondigital. In its nondigital form, gamification can look like games or incentives including punch cards and reward memberships (Seaborn & Fels, 2015). A digital application of gamification creates an environment where the program player interacts with a variety of virtual incentives which then motivates the player to interact with nongame contexts using the gaming components provided (da Rocha Seixas, Gomes, & de Melo Filho, 2016; Johnson et al., 2013). Such gaming components may include performance tracking, points, levels, rewards, leaderboards, and badges (Hemley, 2012; Johnson et al., 2013). With the intention of engaging users, increasing motivation, and improving overall performance, opportunities to join or build virtual, online communities offer program users a unique environment for social interaction (Hemley, 2012).

Although the instructional application of a digital environment is relatively new, active learning (Piaget, 1972; Sedden & Clark, 2016) and game-based learning (Seaborn & Fels, 2015) are not new ideologies when surveying the history of education (Farrell, 2009). Theoretical applications for active learning are documented with contributions from several philosophers including Rousseau (Rousseau & Johnston, 2009), Dewey (1916/1966), and Piaget (1972). Each of these philosophers strongly advocated for hands-on, play-based, real world, and sensory-based learning experiences (Farrell, 2009). Within the context of contemporary learners, passive learning environments develop passive learning habits for students by promoting the rote acquisition of facts (Johnson, Johnson, & Smith, 1991). Furthermore, the passive learning environment interferes with higher-order processing, critical-thinking skills, and the ability to effectively solve problems (Farrell, 2009). The contrast between active learning philosophies and passive learning environments is significant and not surprising. While passive learning yields passive learners, active learning generates active learners (Piaget, 1972).

Traditional direct instruction models feature content specific coursework provided according to a preset algorithm (Kinney & Robertson, 2003). This traditional model features a predictable, teacher-centered, teacher-directed pattern of instruction delivered equally to all students (Kinney & Robertson, 2003). Instruction augmented by technology can individualize instruction by providing academic content to all students according to previously identified areas of strength or need in a way that traditional instructional methods fail to do (Bushnell & Allen, 1967). Technology integration within a mathematics instructional program must be an intentional choice made by the teacher (Jung & Conderman, 2015). An adequately informed teacher is the individual who typically chooses, implements, and evaluates technological applications in the classroom for effectiveness and efficacy in instruction (Jung & Conderman, 2015).

Many times, when technology is integrated into the lesson cycle, the impact upon mathematics instruction is positive (Jung & Conderman, 2015). The National Association for the Education of Young Children (NAEYC; 1996) outlined the educators' responsibility with a published position statement. These responsibilities included evaluating appropriate technological uses, identifying the potential benefits, integrating technology into the natural learning environment, providing equitable accessibility to technology for students of all needs, anticipating issues in software, serving as an advocate, and ascertaining relevant professional development needs (NAEYC, 1996). Similarly, the National Council of Teachers of Mathematics (NCTM) emphasized technology as a critical component in mathematics instruction. The NCTM (2015) position statement on instructional technology outlined the appropriate guidelines for strategically and effectively implementing technology within mathematics instruction.

The New Media Consortium Horizon Report 2013: K-12 Edition Advisory Board reported that technology has the potential to be a driving force for revolutionizing education and should be recognized as a noteworthy factor regarding innovative instructional practices (Vosloo, 2014). Technology is predicted to shift the accessibility of information from the teacher to the internet, while the production of knowledge will be disseminated upon the platform of technology (Hanover Research, 2013). Furthermore, teaching practices and strategies are expected to change from a focus on teaching, which happens according to a carefully planned algorithm, to a focus on learning, which is ongoing and informally occurs in all settings (Hanover Research, 2013). As classroom designs and instructional practices deepen in reliance upon web-based applications and devices, so must engagement strategies evolve (Hanover Research, 2013). In this ideology, mobile learning dependent upon technology ceases to be an innovative technique but rather a reflection of the way 21st century learners learn and communicate knowledge (Hanover Research, 2013).

With the development of various modalities of instructional technology, educators seek effective uses for incorporating this new technology within their classrooms (Roekel, 2008). Educators evaluate technology uses including hardware acquisition, internet consumption, and accessibility for relevant and engaging applications (Roekel, 2008). With internet use on the rise in contemporary classrooms, websites like YouTube, Twitter, and Blogger can give students a social media platform for collaborating with each other and the teacher as well as an audience to publish and share their finished work (Morrison, 2015). By using social media websites such as YouTube, Twitter, and Blogger, students are able to conduct virtual discussions, share pictures, tag and locate other individuals or locations, and make social statements about themselves or environment (Morrison, 2015). What initially began as a debate on whether or not social media

should have a place in the school environment has now become a general acceptance of its presence and a debate for how to most effectively use social media to educate children (Vosloo, 2014). The University of New Hampshire conducted a study and subsequently published an infographic (O'Neill, 2014) addressing social media use by its students. Of the participants polled, 65% of students who used social media were female and 35% of students were male, while 94% of students were enrolled as undergraduate students, and 6% of students were enrolled as graduate students (O'Neill, 2014). Nearly all students (99%) reported accessing social media websites on their phones and frequented websites such as Twitter, Facebook, Instagram, Snapchat, and others in that order of preference (O'Neill, 2014). This information combined with the knowledge that 48% of students polled spent zero to two hours daily, and 45% of students spent three to five hours daily using technology indicates a unique opportunity to blend learning and instruction with technological habits already in place (O'Neill, 2014).

As the World Wide Web transitions to a more dynamic environment, Web 2.0 applications focus on content that is created by internet users for the purpose of increasing accessibility, usability, and interactivity (Naidu & Singh, 2015). Web 2.0 applications such as wikis, blogs, and social media networks have revolutionized the digital arena (Handsfield, Dean, & Cielocha, 2009; Naidu & Singh, 2015). Whereas the internet was formerly a website-owner driven environment dependent on a small group of program developers to write and distribute information, Web 2.0 applications transform the internet into a platform of interactivity, collaboration, and contribution thereby allowing and encouraging internet users to modify the internet through their own interfaces (Handsfield et al., 2009). A study within community college classrooms sought to investigate the integration process of Web 2.0 applications within traditional classroom environments as well as identify any selection and usage preferences of

Web 2.0 tools (Daher & Lazarevic, 2014). The study also sought to identify any boundaries that might restrict further utilization of educational Web 2.0 tools (Daher & Lazarevic, 2014). Within Daher and Lazarevic's (2014) study and through a survey with over 200 participants, Web 2.0 integration was low at 23.8%. Even though a media breakdown into types by function including communication, collaboration, productivity, social networking, and media sharing reported as high as 31.19% (media sharing during teaching), most tools showed minimal use (Daher & Lazarevic, 2014). Lack of integration support, training, and personal experience or familiarity were reported as significant barriers to furthering Web 2.0 integration (Daher & Lazarevic, 2014).

Impactful instruction has the potential to place a significant burden on the teacher in that careful focus must be given to the content area as well as planning for its intended impact towards learning (Craig, 2000). Mathematics, particularly as a content area, tends to be anxiety inducing, which can hinder the degree to which a teacher is able to effectively teach the content area (Tatar, Yılmaz, & Türkan Berrin, 2015). This anxiety is typically rooted in a fear of mathematics which tends to indicate a personal content weakness, a negative prior experience with mathematics, or even a long-standing history of negative perceptions (Tatar et al., 2015). Negative sensitivities may also apply to technology integration, perceiving such usage as a threat to the paradigm of education (Drickey, 2006). As such, these negative perceptions and corresponding feelings of anxiety may adversely impact the delivery of mathematics instruction to the next generation of learners (Tatar et al., 2015). Positive perceptions, on the other hand, toward the combination of technology integration within mathematics instruction demonstrate a negative and statistically significant relationship toward mathematics teaching anxiety (Tatar et al., 2015). This connection between positive perceptions and mathematics teaching anxiety

means that when a teacher acknowledges a practical application for technology in mathematics education, the corresponding level of anxiety associated with the instructional task decreases (Tatar et al., 2015). Intentional curriculum planning when integrated with technology requires teachers to focus on both components while customizing instruction to the various learning needs in the classroom (Craig, 2000). Resources, including the position statements developed by leading mathematics instruction organizations (NAEYC, 1996; NCTM, 2015), can assist teachers in planning and implementing technology-infused lessons thereby reducing anxiety (Tatar et al., 2015) and increasing effectiveness (Craig, 2000; NAEYC, 1996).

Intentional incorporation of technology within an existing mathematics curriculum can positively impact the instruction of key concepts, promote cross-curricular connections, encourage positive social interactions, and improve both teacher and student (Craig, 2000; Jung & Conderman, 2015; Tatar et al., 2015). To achieve these benefits, mathematics instruction with effective technology integration must consider the measure of student engagement expected to increase (Drickey, 2006), the benefits of technology over other possible instructional strategies, and level of preparation to address possible technology related issues (Jung & Conderman, 2015; NAEYC, 1996). Once the appropriate technology tools are implemented, instruction can work to create more meaningful connections, build relevance for individual learners, and promote the internalization of skills (Craig, 2000).

With consideration to the relevant benefits and concerns, technology integration within a mathematics instructional program should follow three primary recommendations. First, such technology integration should consider the learner's perspective before considering other factors such as funding, software, and infrastructure (Johnstone, 2002). Second, the technology selected should add benefit or help provide solutions beyond merely adding to the number of instructional

resources without adding purpose (Johnstone, 2002; Jung & Conderman, 2015; Kinney & Robertson, 2003). Finally, technology instruction should be part of an intentional and thought-out plan with a procedure for evaluating the effectiveness towards achieving the maximum benefit for each learner (Craig, 2000; Jung & Conderman, 2015).

Problem Statement

The educational community is interested in the potential value added by superimposing a digital layer to existing instructional strategies (Al-Bahrani, Patel, & Sheridan, 2015; Hamari et al., 2014). Technology use by teachers and students is increasing. In a survey by WeAreTeachers, internet sourced games were utilized by 55% of teachers to supplement their instruction, and 63% of teachers report that their students demonstrate greater willingness to work on challenging skills when the material is presented in a gaming format (Kroski, 2013). Video games are prevalent in contemporary culture with over 1.2 billion people around the world engaged in digital gaming (Posey Norris & Altevogt, 2015). Erenli (2013) reported that 97% of school-age children play video games and/or computer games with 77% of American households owning personal gaming devices. Video games purport a high impact on student motivation (Haskell, 2012) making the experience more enjoyable to the user (Simoes, Diaz Redondo, & Fernandez Vilas, 2013).

Instructional technology has far-reaching and varied uses within the school setting. With social media usage on the rise by nearly all ages (Al-Bahrani et al., 2015), a look at the growth statistics by Flurry Analytics (2013) reported that overall social media app usage in 2013 increased by 115% from the previous year (Vosloo, 2014). Messaging as a specific component of social media, which includes text and photo sharing, increased by over 200% (Vosloo, 2014). Similarly, the age of the average digital gamer is on a steady decline bringing gamification as an

instructional strategy closer to the age of individuals in elementary and secondary education (Johnson et al., 2013). Students recognize the instructional relevance and actually prefer technology-integrated instruction (Kvavik, 2005). Of 4,374 undergraduate students from 13 different institutions across five states, just 2.9% of students did not prefer technology integration within their learning environment (Kvavik, 2005). Such dramatic increases in instructional technology integration demand further exploration in the efficacy of technology integration within the classroom and its use as an instructional tool to motivate student learning (Johnson et al., 2013).

Some approaches to teaching mathematics have led to less interest and motivation of student engagement (Bishara, 2018). Further research is required to analyze any existing relationship between gamification components and student motivation in an elementary aged instructional setting. A systematic review of studies intending to link gamification and engagement yielded relevant results (Looyestyn et al., 2017). Of the 15 studies reviewed (Allam, Kostova, Nakamoto, & Schulz, 2015; Cechanowicz, Gutwin, Brownell, & Goodfellow, 2013; Denny, 2013; Downes-Le Guin, Baker, Mechling, & Ruyle, 2012; Hamari, 2013, 2015; Harms, Seitz, Wimmer, Kappel, & Grechenig, 2015; Krause, Mogalle, Pohl, & Williams, 2015; Jang, Park, & Yi, 2015; Juzwin et al., 2014; Landers, 2014; Mekler, Brühlmann, Opwis, & Tuch, 2013a, 2013b; Monterrat, Desmarais, Lavoue, & George, 2015; Morschheuser, Henzi, & Alt, 2015), 12 studies indicated positive effects of gamification upon several factors including engagement, time spent in the program, contributions to the program, number of times the program was launched, performance, and healthy behaviors (Looyestyn et al., 2017). Despite the data reviewed and presented by these 15 studies, the impact of gamification upon students' self-reported levels of motivation regarding digital mathematics instruction was not explored by any

of the 15 studies reviewed (Looyestyn et al., 2017). The specific contexts and industries of these 15 studies varied widely and included online learning, economic trading, healthcare, and survey participation (Looyestyn et al., 2017).

Further limiting the existing research, the studies reviewed did not engage a population from an elementary school, focusing only on adults or individuals enrolled in post-secondary education (Looyestyn et al., 2017). While engagement and motivation are connected and a change in either positively impacts student achievement (Reeve & Lee, 2014), most existing studies choose to focus solely on engagement as the dependent variable (da Rocha Seixas et al., 2016; Ibanez, Di-Serio, & Delgado-Kloos, 2014; Leaning, 2015). Since engagement and interest are intrinsic motivators and related to self-efficacy as a construct of self-determination theory (Ryan & Deci, 2000), a wider view of gamification in light of its impact upon motivation for a younger population is needed. Although motivational components are utilized to engage learners (Griffiths, 2014), the goal of a gamified mathematics instructional program is to increase math proficiency through repeated and consistent program usage (Imagine Math, 2018). Beyond simple academic performance, motivation is a critical component for student engagement and is essential to skill retention (Taheri, Nasiri, Moaddab, Nayebi, & Louyeh, 2015). Students are more likely to maintain engagement in an activity, in this case a gamified mathematics program, if they are interested in the activity or connect its value to their own needs (Nakamura & Csikszentmihalyi, 2003).

This study resolved to determine if the gamified elements embedded in elementary-level digital mathematics instructional programs demonstrate any impact upon self-reported levels of motivation. Elementary students who participate in a digital mathematics instructional program at least once per week comprised the population under investigation. As such, the findings of this

study contribute to the existing need within literature, address the efficacy of an industry-wide switch to technology-infused education, and deepen the understanding of previously conducted research utilizing other factors such as age, gender, and impact on behavior (Arning & Ziefle, 2007; Lister, 2015; Venkatesh, Morris, Davis, & Davis, 2003; Williams, Consalvo, Caplan, & Yee, 2009; Williams, Yee, & Caplan, 2008). Specifically, this study differs from other studies found in the literature due to the focus on students' self-reported levels of motivation in lieu of an emphasis on behavior or academic performance as had been the focus in other, related studies (Looyestyn et al., 2017; Pedro, Lopes, Prates, Vassileva, & Isotani, 2015). Whereas existing studies explored gamification in other contexts such as healthcare, economic sales, and survey response (Looyestyn et al., 2017) or examined other variables such as age, gender, and behavioral impact (Arning & Ziefle, 2007; Lister, 2015; Williams et al., 2008, 2009), present literature does not address the impact of gamification in elementary-level mathematics programs upon student motivation. Despite the availability of related research where other factors are explored, elementary students' first-person accounts of motivation within the context of gamification are necessary but not yet thoroughly examined. This necessity is based on the assumption that technology increases motivation as evidenced by a shift in education towards technology integration (Roekel, 2008). Middle school students were reported to be more engaged and produced higher quality academic work when provided with a technology device to learn (Silvernail & Lane, 2007). Based on information from 2008, 23 states in the United States offered online courses or full programs to K-12 students in an attempt to increase accessibility and tailor to students' interests (Roekel, 2008). The prolific nature of technology in education coupled with a lack of research involving elementary aged students provides the necessity of this particular study. Therefore, this study discussed whether gamification is a factor prompting

students to more active learning and increased motivation, particularly when delivered through digital mathematics instruction programs. Researchers and educators alike would benefit from this study which is designed to explore the connection, or lack thereof, between embedded gamified elements in digital mathematics programs and levels of self-reported student motivation by third-, fourth-, and fifth-grade students.

Purpose Statement

The purpose of this qualitative study was to identify how intrinsic and extrinsic motivators embedded within gamified digital mathematics instructional programs contribute to motivation levels of third- through fifth-grade students at an elementary school located in central Texas.

Overview of Theoretical Framework and Methodology

Theories regarding motivation are separated into two predominant categories based on theoretical construct and human drive (Reiss, 2012). Skinner's (1953) operant conditioning theory, for example, connected all behaviors and actions to extrinsic stimuli in a one-sided approach. In contrast, a dualistic approach such as the Deci and Ryan's (Reiss, 2012) theory of motivation states that motivation is driven by both intrinsic motivators and extrinsic motivators.

Deci and Ryan (1985, 2008) refined the theory of motivation and developed self-determination theory to further differentiate between autonomous motivation and controlled motivation. Autonomous motivation provides for motivation from intrinsic sources but also allows for extrinsic motivators if the individual is able to identify and adopt the value of the activity (Deci & Ryan, 2008). Controlled motivation results from the combination of external regulation, a strictly extrinsic source of motivation, and introjected regulation, where an individual partially adopts the value of the activity in an attempt to alleviate external pressures

such as shame (Deci & Ryan, 2008). Whereas most human motivation theories side with either intrinsic or extrinsic motivation in a particular behavior, the interaction between intrinsic and extrinsic motivators contributes to a continuum of motivation (Deci & Ryan, 1985).

A macro-theory within the theory of human motivation, self-determination theory presumes that an active organism is capable of interacting with its internal and external environments along a continuum of extrinsic to progressively more intrinsic motivators for the purpose of satisfying basic human needs (Deci & Ryan, 1985). This continuum is comprised of three dominant categories: amotivation, extrinsic motivation, and intrinsic motivation (Ryan & Deci, 2000). Amotivation is categorized by nonregulatory behavior wherein the individual does not demonstrate value, competence, or control (Ryan & Deci, 2000). The midline of the self-determination continuum features extrinsic motivation which is comprised, in order of most extrinsic or least self-determined to least extrinsic or more self-determined, of external regulation, introjected regulation, identified regulation, and integrated regulation (Ryan & Deci, 2000). External regulation is strictly external wherein the individual acts or behaves in such a way to demonstrate compliance, avoid punishments, or receive rewards (Ryan & Deci, 2000). Introjected regulation involves behavior that is somewhat external and involves self-directed internal rewards and punishments (Ryan & Deci, 2000). Identified regulation moves toward intrinsic motivation and relies on an individual's values and personal beliefs to establish importance (Ryan & Deci, 2000). Integrated regulation bridges extrinsic motivation with intrinsic motivation by stimulating the individual to be self-aware and act within the constructs of his or her own value system (Ryan & Deci, 2000). Intrinsic regulation forms the most intrinsic side of the self-determination continuum where an individual is exclusively driven by interest and enjoyment causing that individual to be self-determined (Ryan & Deci, 2000). This

continuum of extrinsic to intrinsic motivation with each subtype formed the basis of this study's research questions as addressed by the two commercially available surveys selected and the particular subscales measured by each.

Within self-determination theory (Deci & Ryan, 1985), intrinsic and extrinsic motivation drive the reasoning and manifestation of motivation. Intrinsic motivation specifically refers to the decision to act based on personal interest or enjoyment as opposed to extrinsic motivation where the action is dependent on a separate and sometimes unrelated outcome (Ryan & Deci, 2000). Specifically, intrinsic motivation is the foundation of self-determination theory, but more recent research lends purpose and credibility to some forms of extrinsic motivation as an authentic motivator compatible with active participants without prompting resistance or diminishing interest (Ryan & Deci, 2000). As determinants of self-determination theory, intrinsic and extrinsic motivators can either authentically or superficially motivate students to action or even compromise motivation (Ryan & Deci, 2000). When students are intrinsically motivated, they complete a task because of their personal desire or interest in the task or because the task holds specific relevance to their goals or desires (Taheri et al., 2015). According to drive theory, a student who is presented with external motivators may attempt to satisfy a need or earn a reward independent of the actual task (Skinner, 1953). Wigfield, Eccles, and Rodriguez (1998) applied internal versus external motivators in a study considering performance related goals versus social goals and determined that the respect and affirmation of others within a social context, including all forms of school-based interpersonal interactions, had a more considerable influence on students' motivation than a strong focus on performance goals alone. These results support the idea proposed by self-determination theory that motivation is impacted along a

continuum of extrinsic to intrinsic motivators and not exclusively one type of motivator (Deci & Ryan, 1985, 2000).

According to self-determination theory, humans are motivated, both intrinsically and extrinsically, to satisfy three basic needs: autonomy, competency/self-efficacy, and relatedness/recognition (Deci & Ryan, 1985). Autonomy deals with an individual's desire to have control or feel in control of their own behavior (Deci & Ryan, 2008). Competence, or self-efficacy, relates to an individual's need to develop and demonstrate mastery over those tasks that have value and importance to the individual (Deci & Ryan, 2008). Relatedness, or recognition, identifies an individual's need to belong and connect with other humans (Deci & Ryan, 2008). To satisfy these three basic, human needs, extrinsic motivators are external drivers that cause an individual to behave in such a way in response to outside stimuli or in seeking external rewards (Deci & Ryan, 1985). Ideally, an individual would be more driven by intrinsic motivators based on their own core values and personal interests (Deci & Ryan, 1985). Self-determination develops when an individual is intrinsically motivated and driven fully by autonomous motivation (Deci & Ryan, 2008).

Self-determination theory explains the phenomenon whereby intrinsic and extrinsic motivators combine to intrinsically motivate an individual, but it does not provide a clear understanding of the varying degrees of interaction between intrinsic and extrinsic motivators. To address this weakness, self-determination theory provides six mini-theories to address various phenomena that impact motivation: cognitive evaluation theory, organismic integration theory, causality orientations theory, basic psychological needs theory, goal contents theory, and relationships motivation theory. Cognitive evaluation theory addresses the idea that intrinsic motivation can enable or undermine motivation depending upon social and environmental factors

(Deci & Ryan, 2000). Autonomy and self-determination are critical factors in achieving high levels of intrinsic motivation (Deci & Ryan, 2000). Organismic integration theory deals with the level or degree to which an individual internalizes an extrinsic motivator (Deci & Ryan, 2000). If an individual fully integrates the relevance and value as his or her own, the behavior could manifest itself as autonomous choice despite the original extrinsic nature of the motivator (Deci & Ryan, 2000). Causality orientations theory involves an individual's orientation towards an environment (e.g., autonomous, controlled, amotivated) and how that orientation impacts behavior regulation (Deci & Ryan, 2000). Basic psychological needs theory focuses on the three basic needs proposed by self-determination theory: autonomy, competence/self-efficacy, and relatedness/recognition (Deci & Ryan, 2000). Self-determination theory asserts that all three needs are fundamental psychological needs and relate to overall health and well-being (Deci & Ryan, 2000). Goal contents theory connects both intrinsic and extrinsic goals and the achievement of those goals to overall feelings of satisfaction (Deci & Ryan, 2000). Relationships motivation theory explores all forms of relationship, both intimate and formal, to fulfill a basic need for belonging, thus satisfying the need for relatedness and also competence and autonomy to a lesser extent (Deci & Ryan, 2000).

Self-determination theory, particularly the self-determination continuum (Deci & Ryan, 1985; Ryan & Deci, 2000), is used by this study to guide the formulation of research questions and frame the study's findings. The specific research instrument utilized by this study was developed in alignment with self-determination theory thus providing a direct correlation between theoretical framework and study focus. Gamification, as an instructional strategy, has the ability to use a combination of intrinsic and extrinsic motivators to satisfy each of the three

needs proposed by self-determination theory: autonomy, competence/self-efficacy, and recognition/relatedness (Reeve & Lee, 2014).

Qualitative methods were selected as the methodology for this study. Qualitative research strives to develop an understanding of a phenomenon that often poses “how” or “why” questions (McGill, 2017). When answering questions such as these, qualitative studies produce narrative scripts that examine the big picture idea to bring meaning to the larger phenomenon (McGill, 2017). Specifically, the study utilized a phenomenological qualitative design. This particular methodology was selected for two primary reasons. First, it attempted to address the complicated nature of intrinsic versus extrinsic motivation both contributing to student levels of self-reported motivation (Reiss, 2012) by qualitatively exploring the self-reported levels of intrinsic and extrinsic motivation that could be attributed to the gamification components of the program. Second, the depth of data provided by a phenomenological approach (Creswell, 2014) provided the researcher with an opportunity to deeply explore what components, if any, of the gamified mathematics instructional program that the students found motivating. These two reasons directly addressed the overarching research question as well as the two research sub-questions posited by this study. Other studies examining the impact of gamification upon motivation in an instructional setting also utilized a qualitative approach as a component of a mixed methods design with credible results (Ibanez et al., 2014). The researcher used data from interview scripts to identify themes and develop interpretative conclusions to address the research questions proposed by this study.

Research Questions

Grounded in self-determination theory, the researcher sought to answer the following overarching research question in the study: To what extent and in what ways do gamified

components embedded in an elementary-level digital mathematics instructional program contribute to students' motivation levels? From this overarching research question, the following research sub-questions were developed to guide the study:

RQ1. Which extrinsic motivators embedded within an elementary-level digital mathematics instructional program contribute to student motivation?

RQ2. Which intrinsic motivators embedded within an elementary-level digital mathematics instructional program contribute to student motivation?

Assumptions of the Study

The researcher has made several assumptions regarding the population and specific participants selected for this study. The researcher assumed that the participants selected for this study were capable of self-reporting their levels and directions of motivation within the context of a gamified mathematics instructional program. Other researchers purported this same assumption based on the concern that children may or may not possess the necessary cognitive and processing skills to provide valid and reliable data (Docherty & Sandelowski, 1999; Domel, 1997; Gill, Stewart, Treasure, & Chadwick, 2008; Mayall, 2000).

The researcher further assumed that the students can be guided by the researcher during the semi-scripted interviews to narrow the focus of the study to specifically the digital mathematics programs the participants regularly use in school. The process of focusing the topic was the primary goal of the one-on-one semi-scripted interviews during the phenomenological qualitative phase of the study. Despite ethical and practical concerns regarding the validity, quality, vulnerability, consent issues, and confidentiality of qualitative interviews with minors (Gill, Stewart, Treasure, & Chadwick, 2008), the researcher assumed that semi-scripted interview questions provided enough structure to focus the discussion without inadvertently

leading or influencing the child's perspective. Set questions lent structure to the interview while the flexible nature of semi-scripted interviews gave children an opportunity to explore the topic with the researcher (Gill et al., 2008). Member checking was used frequently to ensure that the participants remained focused on the topic of the study (Merriam, 2009; Simpson & Quigley, 2016). Although these assumptions limit the scope of the study, such limitations are necessary to ensure that the study participants are reasonably able to participate in the survey and that the participants' voices are sufficiently heard and reflected in the study's findings (Simpson & Quigley, 2016).

Delimitations and Limitations of the Study

Credible researchers must identify any delimitations and limitations relevant to the study and discuss the impact of those decisions upon the study (Booth, Colomb, & Williams, 2003). Delimitations are those conditions wherein the scope of the study has been intentionally limited by the researcher (Simon & Goes, 2013). Discussion of those delimitations should include a justification for the decision and a proposal of how that omission impacted the data obtained by the study (Simon & Goes, 2013). Limitations are inherent weaknesses or assumptions that are important to the study and yet are beyond the control of the researcher (Booth et al., 2003).

Delimitations. Many components of this study were intentionally limited. Participants were intentionally restricted to third, fourth, and fifth grades. Pre-kindergarten and kindergarten children were not included as participants in the study because the gamification-embedded mathematics instructional programs used at the selected study site were not designed by the programmer to be used by pre-kindergarten and kindergarten children (Cholmsky, 2011; Smolensky, 2015). Despite the fact that children in first and second grade participated in some of the digital mathematics instructional programs available at the research site (J. Choate, personal

communication, April 25, 2018), first and second grades were not included in the study due to a concern of obtaining reliable data when completing a survey through an electronic platform to collect demographic information (Ryan & Connell, 1989). The use of an electronic platform to obtain responses is not considered developmentally appropriate for children under eight years of age (Ryan & Connell, 1989). Demographic questions presented during the electronic survey screened for participants below eight years old. No participants in this study responded as being younger than eight years old, but the researcher would have removed any data belonging to participants who were determined to be too young to participate in the study. This minimum age selection was made despite the possibility that attitudinal perceptions may already be established by the third, fourth, or fifth grade (Tatar et al., 2015).

Age, grade level, and gender were identified by the demographic questions found in the survey and were used to establish a target research sample but were intentionally excluded as variables in this study. Current research studies have already established conclusions regarding the impact of age (Koivisto & Hamari, 2014) and gender (Koivisto & Hamari, 2014; Pedro et al., 2015) upon levels of motivation within gamified settings. Rather, using age and gender for a context and purpose similar to this study may be appropriate for future studies. The setting of the study was thoughtfully restricted in scope. The specific site was selected for its eligible student population size of $N > 300$ (J. Choate, personal communication, April 25, 2018).

Mathematics was the only content area examined in this study due to the existing research regarding students' negative perceptions toward mathematics (Tatar et al., 2015), making the study of motivational impact interesting and relevant to the field of education. Mathematics is also more conducive to concept isolation and individual skill instruction (Duhon et al., 2004; Leone, Wilson, & Mulcahy, 2010). Restricting the study site and content focus

provided specificity and clarity for the researcher, thus the data is expected to be narrower and focused in nature.

Limitations. Many factors related to this study fell beyond the scope of the study or are inherent weaknesses to the study. The specific gamified digital mathematics instructional programs selected by the school district was a factor beyond the control of the researcher. This study was not experimental in nature, meaning that the researcher did not manipulate any of the variables, leaving the phenomenon within its unaltered context to be observed and explored (Kosuke, Keele, Tingley, & Yamamoto, 2011). The lack of site manipulation does limit the research in that the data obtained by the study is observational and cannot be compared to a control group, as one does not exist. Although this study discussed the impact of pre-existing attitudinal perceptions of mathematics instruction and the impact of those perceptions on future interactions with mathematics (Abbitt, 2011; Tatar et al., 2015), this study cannot and did not attempt to control pre-existing perceptions towards mathematics that may have been established prior to participation in the study. Instead, this study measured only the perceptions of student motivation as reported at the specific time of student participation in the survey or interview portions of the study. Some demographic information was requested using an electronic survey, but the findings of this study should not be construed as comprehensive or representative of the general population presenting a limitation that the student population represented in this study along with their self-reported levels of motivation cannot be extrapolated past the setting of the study (Simon & Goes, 2013). Generalizations made by this study are relevant only to the specific site selected and should not be generalized beyond the study site regardless of similarities in student population or program usage (Creswell, 2014). Replication of this study with similar

populations and research questions may not produce comparable findings due to the complicated nature of qualitative research (Wiersma, 2000).

Significance of the Study

The findings of this study could have significant impact on the existing body of literature. Contemporary classrooms integrate technology, particularly computer programs featuring elements of gamification, as a strategy to motivate 21st century learners in the contemporary classroom (Daher & Lazarevic, 2014) but without a decisive connection between the strategy and its impact upon motivation. Such integration is grounded in the assumption that gamification strategies found in nonacademic video games can have a similar motivational impact in the instructional setting (Seaborn & Fels, 2015; Yoke Seng, Maizatul Hayati binti Mohammad, & Wee Hoe, 2015), but research regarding the use of such technology in an instructional setting is limited. This study could contribute to the current, limited research in the use of gamification as an instructional strategy for student motivation as indicated through an analysis of self-reported student attitudes and perceptions. Whereas existing research explores factors such as engagement, age, gender, and impact on behavior (Arning & Ziefle, 2007; Koivisto & Hamari, 2014; Lister, 2015; Looyestyn et al., 2017; Pedro et al., 2015; Venkatesh et al., 2003; Williams et al., 2008, 2009), self-reported levels of motivation for elementary-aged students participating in a gamified mathematics program have not been explored as of yet.

With the recent development of online learning platforms for elementary and secondary education (Roekel, 2008), this study would serve as a foundation for future research studies seeking to connect other forms of technology, beyond gamification, with motivation. Additionally, self-determination theory has produced six mini-theories based on observable phenomenon within different contexts and by the unique interaction of different manifestations

of intrinsic and extrinsic motivation (Deci & Ryan, 2000). The phenomenon explored by this study could indicate the potential for additional mini-theories stemming from self-determination theory and connecting to technology or social media usage.

This study also has potential implications for the field of education. Students are expected to learn content-specific material that is relevant to their everyday world (Craig, 2000). Part of this expectation includes the ability to apply content within real-life situations (Craig, 2000). For 21st century learners, such application requires technological literacy working in tandem with the traditional content areas (Craig, 2000). With a focus on mathematics, certain higher-order skills such as problem-solving, number sense, pattern identification, and complex reasoning (Craig, 2000; NCTM, 2015) often cause anxiety for the learner that can lead to failure or avoidance of the learning task (Tatar et al., 2015). Beyond simply alleviating feelings of anxiety in students, technology can provide alternate instructional settings including distance learning, flipped learning, and hybrid instruction offering students feelings of choice and flexibility in their own learning (Kinney & Robertson, 2003). Through technology, students can demonstrate autonomy over their learning experience by determining the "where, when, and how they learn mathematics" (Kinney & Robertson, 2003, p. 316) leading to improved student outcomes. Since integrating gamification as a motivational strategy can increase skill levels and content mastery (Hanus & Fox, 2015), assist students and teachers by increasing self-confidence (Oskar, Sherry, Denise, Andrew, & Tak-Wai, 2014), and decrease anxiety (Seaborn & Fels, 2015), this study could be beneficial in improving current and future educational programming decisions. In addition to decreasing negative perceptions and lowering levels of anxiety, technology integration within mathematics instruction can increase student motivation and productivity (Tatar et al., 2015). If mathematics instructors have data to support gamification as a means to

increase student motivation and thereby increase productivity, teacher and student anxiety may decrease leading to greater feelings of self-efficacy.

The findings of this study also give a first-person voice to the benefits of gamification perceived in the literature that asserts gamification as a motivator for students. Students need to have the flexibility to customize their own learning experience and can accomplish this by adjusting the timing, frequency, setting, and topic (Kinney & Robertson, 2003). A study such as this one regarding motivation and gamification integration benefits from the direct study of the students' perceptions. Once specific motivators are identified, teachers can use the findings of this study to focus the emphasis of their own motivational strategies. If teachers have knowledge of effective practices, the real-life integration support of gamified learning programs can be tailored to students' interests, thus motivating students in both a real-world and virtual context.

From a fiscal viewpoint, technology-related resources can be a more cost-effective method of content delivery once the initial cost of development has been paid (Kinney & Robertson, 2003). If motivation is positively impacted by gamification integrated mathematics programs, then this study could support policy decisions regarding district and even statewide-adopted technology programs. Additionally, technology reduces the bulk of tangible materials and increases the types, variety, and availability of instructional resources (Kinney & Robertson, 2003). The various technology resources available may include virtual manipulatives (Drickey, 2006), extra review lessons, limitless opportunities to practice, media depicting key concepts, live tutors, interactive tutorials, and supplemental materials (Kinney & Robertson, 2003). These fiscal and materials management decisions could be significantly impacted by the findings of this study. As the education field is continually impacted by current research and new policies, a study such as this one that focuses on a newly developing sector of education could be

instrumental in guiding the development of new programs. This study could also impact the guidelines and requirements written to govern the selection of programs, the adoption of certain programs over others, and eventually the successful implementation of the programs that have been selected.

Findings from this study have the potential for wide-reaching impact. This study can contribute to the existing body of research, support further theory development, provide practical applications in the field, and guide the development or improvement of existing education policies. The application of self-determination theory to self-reported levels of motivation in response to participation in elementary-level gamified mathematics programs combined with the selected population and methodology is unique, providing a previously unexplored perspective on motivation.

Definitions of Terms

Autonomy. This construct is one of the three basic needs identified by self-determination theory and is a key component toward increasing feelings of intrinsic motivation (Deci & Ryan, 2000). This need is directly related to feelings of choice and leads an individual towards an internalization of the behavior (Deci & Ryan, 2000). Motivation can progress along a continuum "from amotivation or unwillingness, to passive compliance, to active personal commitment" (Deci & Ryan, 2000, p. 60) with the addition or removal of choice.

Engagement. The term may manifest in behavioral, emotional, or cognitive forms (Fredricks, Blumenfeld, & Paris, 2004). Focusing on the academic setting, the behavioral form refers to student participation in school-related activities while maintaining a positive attitude toward those activities while the emotional form refers to the emotional response a student experiences towards school activities (Fredricks et al., 2004). This study will focus on both the

behavioral and emotional response as it relates to a student's motivation to participate in a gamified mathematics instructional program and maintain a positive attitude toward those learning activities.

Enjoyment. Synonymous with interest within the context of an intrinsic motivator, the term refers to an individual's choice to complete an activity or demonstrate a behavior for the sake of the joy the activity brings the individual regardless of external benefits or rewards (Deci & Ryan, 2000).

External regulation. As an example of extrinsic motivators explored in this study, this particular subtype involves behaviors stimulated by an external demand or in an attempt to achieve or obtain an external reward (Deci & Ryan, 2000).

Extrinsic motivators. This component of motivation is typically defined as participating in a behavior, action, or task contingent upon an external stimulus or incentive (Legault, 2016). This study focuses on recognition and relatedness as the basic needs within self-determination theory satisfied by external motivators (Deci & Ryan, 1985). Within the interview instrument developed for this study, three subtypes are explored including external regulation, introjected regulation, and identified regulation (Ryan & Connell, 1989).

Gaming. This term can be defined or exemplified in a variety of ways based on cultural or historical context. It is considered autotelic, existing only for the purpose of the activity itself (Koivisto & Hamari, 2014) and is defined as an activity consisting of rules, an objective, an element of predictability, chance or strategy, role-play, and conflict with a corresponding resolution (Seaborn & Fels, 2015) but does not require a technology component.

Gamification. As an application of gaming components to nongame activities (Raymer, 2011), the term refers to components used to specifically engage and motivate the user (da Rocha

Seixas et al., 2016). Such components include goal setting, rewards (typically offered through a point or scoring system), and community participation through ranking and recognitions (e.g., badges, medals, leaderboards; da Rocha Seixas et al., 2016; Johnson et al., 2013). These structures result in participants receiving instant feedback regarding their progress through the program (da Rocha Seixas et al., 2016). This application of gaming principles to nongame contexts tends to have a larger goal or purpose beyond the activity itself (Koivisto & Hamari, 2014).

Identified regulation. As a component of extrinsic motivation, this particular subtype is more autonomous than other extrinsic motivators and yet still involves a form of behavior regulation by requiring that the individual assign personal value to the behavior (Deci & Ryan, 2000).

Intrinsic motivators. This component of motivation is typically defined as participating in a behavior, action, or task for its own value (Reiss, 2012), satisfaction, or enjoyment (Legault, 2016). This component of motivation satisfies the basic needs of self-efficacy and autonomy as proposed in Deci and Ryan's (1985) self-determination theory. Within the interview instrument developed for this study, specific subtypes are explored including interest/enjoyment, perceived competence, effort/importance, perceived choice, value/usefulness, and intrinsic motivation (Ryan & Connell, 1989).

Introjected regulation. A component of extrinsic motivation, this particular subtype involves internally generated feelings of pressure toward a behavior in an attempt to diffuse guilt, lower anxiety, or maintain pride (Deci & Ryan, 2000).

Motivation. A narrow definition of this term applicable to this study is "the level of effort an individual is willing to expend towards the achievement of a certain goal" (Brennen,

2006, para. 3). The focus of this definition is the concept of "willingness" on the part of the participant to sustain a desired behavior (Kroski, 2013; McDevitt & Ormrod, 2006). This definition uses a dualistic approach (Reiss, 2012) and includes both intrinsic and extrinsic motivators as contributors (Ryan & Deci, 2000).

Self-efficacy. Also known as perceived competence, this term is an intrinsic motivator that satisfies an individual's need to feel competent (Deci & Ryan, 2000). This motivator is closely connected to an individual's need for autonomy so much so that in order for perceived competence to positively impact intrinsic motivation, it must be accompanied by an individual's feelings of autonomy (Deci & Ryan, 2000).

Organization of the Study

This dissertation is comprised of five chapters. Chapter 1 began with a discussion of the background and contextualization of the issue. This discussion led to the development of the problem statement. The purpose of the study was then asserted as a means to connect self-determination theory, as the theoretical framework, to the specific methodology selected to address the problem. Research questions that aligned with self-determination theory and the problem statement were presented. The researcher then identified the assumptions made within the context of the study. A discussion of the delimitations and limitations outlined those factors that the researcher intentionally controlled along with those factors recognized by the researcher as potentially contributing to the study's findings and yet beyond the researcher's control (Booth et al., 2003; Simon & Goes, 2013). The researcher then proposed several contributions this study is expected to make to the existing body of literature, the field of education, and future education policy development. Chapter 1 then outlined the definitions of industry and study specific terms before reviewing the organization of the study and summarizing the initial discussion.

Chapter 2 includes a review of technology as an instructional strategy to lend additional context to the study. Within instructional technology, the development of game-based learning and ultimately gamification will be discussed. Gamification is then connected to education as an instructional strategy to provide context and justification for the study. Benefits and criticisms of gamification in education as found in current literature deepen the discussion before the researcher indicates the gaps and weaknesses in the existing body of literature. Chapter 2 then transitions to a discussion of the theoretical framework guiding this study. The development of different theories regarding motivation are discussed, leading the reader on an exploration of the evolution of theories regarding human motivation. Self-determination theory, as a sub-theory under the theory of motivation (Deci & Ryan, 1985), is specifically identified as the theoretical framework for the study. The discussion includes the development of the theory, presentation of the six mini-theories that comprise self-determination theory, the basic needs identified by self-determination theory, and the application of self-determination theory within contemporary education. Extrinsic and intrinsic motivators are discussed along with support from existing literature regarding the use of motivational strategies to produce a positive impact upon students.

Chapter 3 details the methodology selected and outlines the research procedures that are used. The discussion includes the specific method and subtype selected for the study with justification for the selection. Chapter 3 then provides specific information regarding the site and population selected for the study including the measures that the researcher took to access the site and specific participants. A description of the participants involved in the study is presented along with a discussion regarding the alignment between the selected population and the phenomenon under investigation. Ethical issues and permissions regarding the interaction between the researcher and the participants are reviewed. A discussion of the data sources,

research protocols, and instruments used by the study are discussed. Data collection procedures are outlined. The researcher then discusses her positionality and provides methods for ensuring trustworthiness and rigor. Data analysis techniques are presented before the chapter concludes with a discussion of alignment between all elements of the study including problem statement, purpose statement, theoretical framework, research questions, data collection protocols, data analysis, and study conclusions.

Chapter 4 provides a discussion of the data collected and subsequently analyzed by the study. The chapter includes a description of the target research sample and data producing sample. The researcher then details how the data are prepared for analysis. Findings from the data are presented and analyzed according to each research question Chapter 4 concludes with a reflection of the data collection and analysis contained within the chapter before it previews the summary and suggestions within Chapter 5.

Chapter 5 summarizes the study with a generalization of the major findings. Based on the findings presented within the study, the researcher develops and presents conclusions and interpretations of the findings. These conclusions and interpretations provide for a discussion regarding relevant implications for this and future studies. Suggestions for future research are presented. A discussion of the study's limitations and components the researcher chose to exclude from the study are reviewed, discussed, and justified. Chapter 5 concludes with a summary of the study that connects all components of the study in alignment and offers closing comments regarding the significance and implications of this study.

Chapter Summary

Games are a near universal part of culture and have been a part of instruction for quite some time (Manusos, Busby, & Clark, 2013; Yoke Seng et al., 2015). Within a technology

context, digital games apply the same components of interactivity and user participation as traditional games but on a modified platform (Seaborn & Fels, 2015). Additionally, digital games intended for a learning context must carefully consider the content, setting, and interface for usability, engagement, and stamina so that the learner first engages in the game and then persists through the game to experience the learning tasks alike (Yoke Seng et al., 2015). Shifts in gaming populations appeal to a greater demographic of males and females and are increasingly more appropriate for individuals of all ages leading to a crossover from entertainment to educational applications (O'Neill, 2014). Despite these shifts and the popularity gaming experiences among many varied demographic populations (Seaborn & Fels, 2015), the move to game-based learning and the impact of gamification upon student motivation levels requires additional exploration by game developers and researchers alike (Yoke Seng et al., 2015).

Researchers have begun to identify some significant results for gamification within an educational context. Learners report that simulations are comparable to the action itself (Laskaris, 2014). When an individual has the opportunity to perform a digital simulation repeatedly, retention increases to 90% (Laskaris, 2014). This increase in retention is significant when compared to retention rates of 10% of what the learner reads and 20% of what they hear (Laskaris, 2014). Similarly, nearly 80% of adult learners reported that they would be more engaged and ultimately more productive if gaming programs were utilized at the college or industry level (Laskaris, 2014). With respect to motivation, 90% of learners described gamified programs as "fun" (Laskaris, 2014). As the purpose of gamification is to increase engagement and motivation while simultaneously improving performance, preliminary research supports gamification on some levels while relevant literature indicates that implementation and impact are not fully established and will require additional research and development.

An argument is only properly supported when the researcher provides clear alignment between the warrant and the claim (Booth et al., 2003). Creswell (2014) detailed the flow of one study component into another to build a persuasive and clearly articulated argument that guides the audience on a journey of understanding and comprehension. This study seeks to explore the impact of gamification upon motivation in an environment established by participation in a gamified mathematics instructional program. Stemming from the constructs of self-determination theory (Deci & Ryan, 1985), this study focused on self-reported levels of motivation, namely the extent to which gamification impacts motivation and the specific intrinsic and extrinsic motivators that contribute to overall feelings of motivation. To address this purpose and the subsequent research questions that came from it, an interpretative phenomenological qualitative design was selected. An electronic survey provided demographic information for a target research sample which then allowed the researcher to identify a data producing sample to explore participants' motivation levels with exposure to gamified components embedded within elementary-level digital mathematics instructional programs. The phenomenological interviews conducted allowed the researcher to guide participants in a discussion centered on the theoretical framework regarding the specific extrinsic and intrinsic motivators utilized by gamified mathematics programs. The interviews further explored how, why, and to what extent certain components of the mathematics program are perceived to be more motivating than other components thereby addressing RQ1 and RQ2. Data derived from the interviews were used to address the problem statement. The findings from this study support the conclusions that were drawn as well as provide research data to support the study's significance. Such implications and conclusions have the potential to provide information that can be used to broaden the existing body of literature and impact future mathematics program development or implementation.

This synopsis of the research study demonstrates alignment flowing from the theoretical framework to the purpose statement and capstones in the formulation of the problem statement. From the problem statement came an overarching research question and two research sub-questions specifically constructed to explore student motivation. The subsequent methodology was best suited for the context and theoretical framework as well as appropriately addressed the research questions developed within the context of the selected theory.

Chapter 2: Literature Review

Chapter 2 provides a thorough review of gamification and this study's connection to self-determination theory as the theoretical framework. The purpose of this qualitative study was to identify how intrinsic and extrinsic motivators embedded within gamified digital mathematics instructional programs contribute to motivation levels of third- through fifth-grade participants at an elementary school located in central Texas. Participation in a gamified digital mathematics instructional program was the independent variable explored by this study. As such, a discussion of gamification as a component of instructional technology and its use as an instructional strategy lends greater context to the study. Along with a discussion of the development of gamification, this literature review provides supporting information from the existing body of knowledge to identify benefits and criticisms of gamification. Based on the discussion of gamification, the strengths and weaknesses of existing research is discussed which then establishes the relevance for this study.

Self-determination theory was used to guide the focus of this study towards an exploration of students' self-reported levels of motivation. The researcher focused on the two determinants of motivation (intrinsic and extrinsic motivators) that are used to meet the three basic human needs posited by self-determination theory: autonomy, self-efficacy/competence, and recognition/relatedness (Ryan & Deci, 2000). As such, a discussion of the evolution of theories regarding motivation and human behavior is presented to provide historical context before delving into self-determination theory. The theoretical literature review includes a discussion of the motivation continuum along the primary types and subtypes of motivation. The two main types of motivation, intrinsic and extrinsic (Ryan & Deci, 2000), are reflected within this study's research questions. The subtypes of intrinsic and extrinsic motivation are reflected in

the interview instrument developed for this study. The six mini-theories that comprise self-determination theory are presented and discussed to support the conclusions made by this study, namely that student motivation is impacted by a combination of intrinsic and extrinsic motivators. The chapter concludes with an application of self-determination theory including the impact of motivation upon achievement along with strategies to improve student motivation.

Instructional Technology

Beyond traditional classroom-based motivational strategies, traditional instructional methods can no longer be used exclusively to engage students but must be augmented with technology and other engaging activities in response to students' expectation and dependence on such strategies (Lumpkin, Achen, & Dodd, 2015). Technology is a fundamental part of culture (Clough, Olson, & Niederhauser, 2013). Technology was developed as a construct of democracy to make information instantly available and accessible to all people (Clough et al., 2013). Contemporary philosophies that consider the integration of technology and its application conclude that, in general, technology serves to benefit life by reducing the limitations imposed by nature or natural routines (Clough et al., 2013). When applied to education, technology used as a tool for progress is an intriguing concept. Within this mindset and for this purpose, education delivered through technological means becomes a convenient and culturally relevant tool whereby knowledge can be disseminated (Clough et al., 2013). Technology integration encourages students to collaborate, explore, improve critical-thinking, apply a variety of communication-based skills, and practically apply knowledge within a 21st century platform thereby preparing students more effectively for future jobs (Lumpkin et al., 2015). Specific technology-based classroom strategies, including enhanced visuals, interactive opportunities, alternative content presentation methods, computer and online games, blogs, collaborative and

individualized response systems, and multimedia, all have an impact on student learning and student perceptions of their own motivation (Lumpkin et al., 2015). Each of these strategies can effectively impact student motivation by building relevance through connecting experiences to real-world application (Lumpkin et al., 2015). This positive impact on motivation causes students to focus on the material presented while promoting additional time and effort spent on the material and stimulating interest (Lumpkin et al., 2015). Additionally, these strategies can help students organize course content into a meaningful format that presents a manageable challenge (Posey Norris & Altevogt, 2015). In this manner, students engage in the content more deeply through increased critical-thinking and questioning (Lumpkin et al., 2015).

Gamification. Games and gamification are an emerging trend in instructional technology expected to peak within the next couple of years (Johnson et al., 2013). Games can support intrinsic motivation through the promotion of group collaboration and appeal to student interests (Felicia, 2012). While teachers are continually discovering and implementing new and innovative strategies to engage an ever-evolving diversity of learning styles and student interests, games have long been used to motivate individuals to engage in the activity for enjoyment and inadvertently learn new content in the process (Manusos et al., 2013; Yoke Seng et al., 2015). Despite a widespread positive attitude towards gamification among teachers, a disproportionate percentage of teachers set out to regularly integrate technology in a meaningful way for instructional purposes (Marti-Parreno, Sequi-Mas, & Segui-Mas, 2016). In response to the surge of learning and instruction moving to an online platform, program developers looked to gamification to incorporate strategies for motivating and engaging students of all ages. As a part of a survey for leaders in education to predict noteworthy trends, Dempsey (2014) revealed that the first wave of dynamic and personalization oriented programs has run its course resulting in

widespread development and improvement in the data obtained, use of the data, metrics in place to modify the program, and personalization for students and teachers. Gamification, as it has evolved, has caught the attention of educators and has been adapted for school use as a means of appealing to young students (Simoes et al., 2013). Understanding the role of motivation and specific motivators within the classroom is a critical component of effective classroom instruction (Reeve & Lee, 2014). Increased student engagement leads to initial changes in motivation and impacts a sustained increase in satisfaction and self-efficacy (Reeve & Lee, 2014). Reeve and Lee (2014) determined that an increase in student engagement accurately predicted an increase in overall course achievement. Likewise, the application of motivators may also be a powerful contributor to the success of an instructional program, particularly a gamified program. Many young learners approach the learning environment with a natural sense of curiosity and demonstrate an intrinsic motivation toward learning (Deci & Flaste, 1996). Maintaining this perspective can be difficult for educators (Hanus & Fox, 2015). The teacher significantly contributes to student motivation through the development of the classroom atmosphere and instructional approaches selected for use (Ryan & Deci, 2000). The teacher further contributes to motivation through the decision to use motivators, both intrinsic and extrinsic. Intrinsic and extrinsic motivators that require active participation and offer choice as opposed to passive and controlling motivators better maintain student interest and engagement (Ryan & Deci, 2000). As technology continues to develop, gamification strategies can become more engaging for students and powerful for teachers (Lawley, 2012). Furthermore, as the initial round of gamification development runs its course, subsequent development combined with the findings from studies such as this one can address the weaknesses revealed by its predecessors.

Cognitive benefits, one of the three modalities identified by Walsh (2012) as positively impacted by gamification, include the development of problem-solving and critical-thinking skills. The cognitive demand increases as students' progress through increasingly more difficult levels of a gamified program demonstrating increasing levels of content mastery (Walsh, 2012). Gamification uniquely addresses emotional needs (Walsh, 2012). In the typical classroom setting, children need to receive both positive verbal reinforcement or affirmations and experience measurable success in terms of grades from the teacher (Deci & Ryan, 1985; Walsh, 2012). Negativity from the teacher and negative reactions to student work are typically counterproductive to the learning process (Deci & Ryan, 1985; Walsh, 2012). Gamification, however, sets up an environment where failure is a natural, almost expected, component of learning (Kapp, 2012a). Students are compelled to work through failure in an attempt to advance through the program. In this setting where failure is part of the process, students approach the gamified task with the understanding that they will need to make several attempts before experiencing success, but the "payout" or reward of finishing a level or meeting a goal supersedes the negative feelings previously experienced (Simoes et al., 2013; Walsh, 2012). Finally, gamification provides social benefits to students (Ryan & Deci, 2000; Walsh, 2012). A component of gamification is the act of role-playing or assuming the identity of an avatar or fictional character in the program's plot for the purpose of the program (Jackson & McNamara, 2013; Simoes et al., 2013). Through this component of gamification, students can explore their personalities and social interactions within the context of the avatar or character in the form of sociodramatic play (Simoes et al., 2013; Walsh, 2012). Such play is important for a child's emotional development (Walsh, 2012).

Gamified elements such as adopting an avatar alter ego, role-playing as the heroic character of a gamified storyline, or dominating the leaderboard of the program (Johnson et al., 2013) can motivate the user, thus extending the amount attention of given to the program (Yoke Seng et al., 2015). Culturally, such gamified elements are already adopted by the video gaming industry to increase user enjoyment (Simoes et al., 2013). If the program is educational, a rote-learning task, such as a timed recitation of addition facts, might appear more motivating within a gamified program resulting in longer participation and increased engagement in the learning task (Yoke Seng et al., 2015). With its emphasis on rewards, levels, points, and other motivators that are both extrinsic (a reward is at stake) and intrinsic (all rewards are virtual and fictional constructs based entirely on the arbitrary value placed on them), gamification can be both motivating and engaging for students. The phenomenon of using games within education to encourage and extend learning is known as game-based learning (Simoes et al., 2013). Game-based learning is comprised of commercially produced video games where (a) learning is a side effect and not the goal, (b) serious games where a video game is produced for learning, and (c) games designed and built by students (Van Eck, 2006). Figure 1 conceptualizes these three manifestations of game-based learning along with the limitations of each (Simoes et al., 2013).

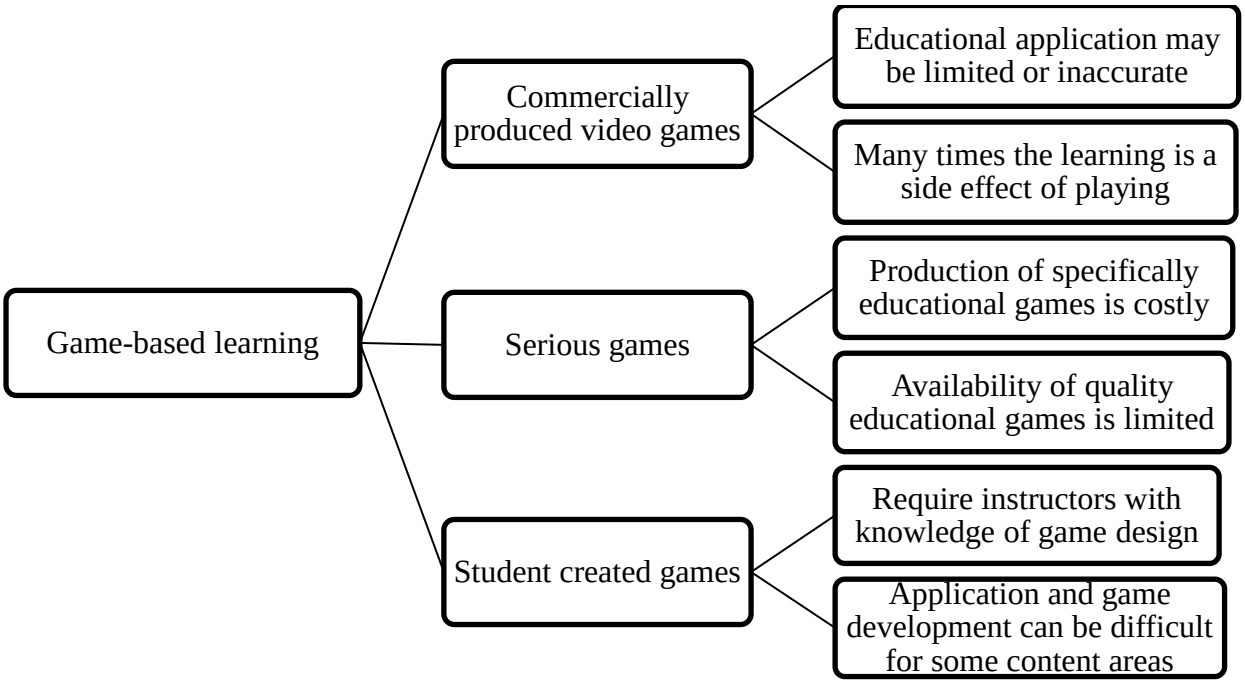

Figure 1. Three components of game-based learning and the limitations of each. Adapted from "A Social Gamification Framework for a K-6 Learning Platform," by Simoes et al., 2013, *Computers in Human Behavior, 29*, p. 346. Copyright 2012 by Elsevier Ltd.

In contrast to game-based learning, gamification endeavors to use gaming elements to increase student engagement, boost motivation, and ultimately engage students in an interactive learning experience without being tied to any one game in particular (Simoes et al., 2013). Gaming elements found in commercially produced video games or serious games can then be incorporated into nongame contexts while still being expected to stimulate motivation and engagement (Wu, 2011). This incorporation of gaming elements in the form of gamification can then be applied to learning processes and contexts as an instructional strategy designed to motivate and engage students (Lee & Hammer, 2011).

Gamification as an instructional strategy. Research has been conducted to explore the effects of age and gender, as variables, on the effectiveness of gamification (Arning & Ziefle, 2007; Venkatesh et al., 2003; Williams et al., 2008, 2009). Built on the premise that computer games integrated into the daily activities of students has been shown to increase student

motivation and ultimately learning, a research study on gamification by Lister (2015) sought to analyze the extent to which gamification components including points, user badges, leaderboards, and program levels truly support motivation and achievement, particularly at the post-secondary level. Such gamified components were expected to boost student interest (Johnson et al., 2013) thereby increasing the motivation to complete the learning task. Lister's (2015) analysis of 19 studies compared and contrasted specific gamification components by identifying patterns and themes across all of the studies reviewed. Of the studies examined by Lister (2015), one study used middle school students (Abramovich, Schunn, & Higashi, 2013), 17 studies used undergraduate and graduate students (Barata, Gama, Jorge, & Goncalves, 2013; Berkling & Thomas, 2013; Charles, Charles, McNeill, Bustard, & Black, 2011; de-Marcos, Dominguez, Saenz-de-Navarrete, & Pages, 2014; Dominguez et al., 2013; Gasland, 2011; Goehle, 2013; Haaranen, Ihantola, Hakulinen, & Korhonen, 2014; Hanus & Fox, 2015; Li, Dong, Untch, & Chasteen, 2013; Mayer & Johnson, 2010; McDaniel, Lindgren, & Friskics, 2012; Mekler et al., 2013a, 2013b; Meyer, 2008; O'Donovan, Gain, & Marais, 2013; Turner, Dierksheide, & Anderson, 2014), and one study did not use a student population and instead developed a gamified program (Watson, Hancock, & Mandryk, 2013). Despite the compiled results of these studies, research that specifically addresses the impact on student motivation in an elementary-aged academic setting is lacking. Another study analyzed age as a factor and focused on value instead of motivation (Venkatesh et al., 2003). The study indicated that younger aged technology users tended to value the usefulness of technology (Venkatesh et al., 2003) more than older technology users who struggled with computer anxiety and preferred the ease of use when determining the value (Arning & Ziefle, 2007). Relevance and accessibility or ease of use directly relate to increased learner motivation (Hu, 2008). Another study that utilized

gender as a variable indicated that women tend to spend more time in gaming environments than men (Williams et al., 2008, 2009).

Based on prior research regarding motivation, Guay et al. (2010) examined student motivation toward a specific content area and specific concepts that were self-reported by young elementary students (Guay et al., 2010). In addition, the study looked to identify the role age might play in a child's ability to differentiate between varying types of motivation to build understanding regarding how motivation develops over time with respect to age (Guay et al., 2010). The results indicated that elementary students were able to self-report varying levels and varying types of motivation (Guay et al., 2010) but the scope of the study was limited to content areas and not specific to gamification.

A similar study also looked to investigate student motivation but with the intention of more closely examining the relationship between level of motivation and age as a contributing factor (Gillet, Vallerand, & Lafrenière, 2012). Intrinsic motivators positively impacted learning, performance, and enjoyment while extrinsic motivators undermined the learning goals and adversely impacted overall motivation (Gillet et al., 2012). This observation has been both confirmed and contradicted by similar studies (Ibanez et al., 2014). With respect to student age, motivation tends to decrease as student age increases (Gillet et al., 2012). As Ryan and Deci (2000) determined, an individual's interests and corresponding levels of motivation are directly related. This phenomenon leads to a possible conclusion that decreasing motivation as age increased could be related to a corresponding decrease in interest with school-related activities (Gillet et al., 2012).

Landers and Armstrong (2015) explored the instructional use of gamification in an empirical study by contrasting gamified instruction with traditional instruction (delivered

through a PowerPoint presentation) and analyzing participant performance. The study concluded that there existed a correlation between familiarity with the technology being utilized and overall success (Landers & Armstrong, 2015). The results of Landers and Armstrong's (2015) study indicated that the effectiveness of gamification may be limited or impacted by specific contexts and further identified a correlation between students' attitudes toward gamification and instructional outcomes. Specifically, students who approached a gamified task with positive attitudes were more successful than those who maintained a negative attitude towards the technology-infused task (Landers & Armstrong, 2015). Whether a student presented with a positive or negative attitude was largely dependent on familiarity with the type of task required as well as the individual's level of expected value from the task (Landers & Armstrong, 2015).

From a meta-analysis of 19 different studies, Lister (2015) identified three main themes concerning gamification: common elements, impact on motivation, and effect on student performance. Through the specific components of gamification examined by Lister (2015) in this research study, gamification was found to impact student performance through increased class attendance and participation positively. However, limitations within the existing research and articles lack a definitive conclusion between gamification and motivation while varying definitions or inconsistent applications of terminology confound existing studies (Seaborn & Fels, 2015).

Benefits. Gamification can be an effective motivator in some contexts. In a nonparametric study to analyze the correlation between gamification and increased motivation, Hamari and Koivisto (2013) determined that gamification was a notable characteristic of motivation. In order for gamification, as an instructional strategy, to be used successfully as a student motivator, this current study focuses on the critical elements of self-determination theory.

Such components include intrinsic motivation (i.e., the desire to learn and succeed for oneself), extrinsic motivation (i.e., a need met through leaderboards, success badges, and point awards), and mastery or performance goal orientation (i.e., a focus on the learning of a skill or successful completion of a task, sometimes within a competitive context; Kitsantas, Steen, & Huie, 2009). Educators further recognized gamification for its contribution toward increasing learner productivity and stimulating creative inquiry (Johnson et al., 2013).

Ultimately, the purpose of an instructional program is to impact academic growth positively (Imagine Math, 2018). Likewise, student growth would be the expectation of gamified technology in education. Whereas a teacher might spend extensive time, effort, and energy to differentiate instruction to students of various learning styles and academic readiness, gamified technology is programmed to effortlessly individualize for students based on skill level and rate of mastery (Hanus & Fox, 2015). Technology programs are also beneficial for leveling instruction effectively and as such yielding beneficial diagnostic information regarding a student's performance levels and academic abilities (Yoke Seng et al., 2015). While such instruction delivery and subsequent data are beneficial to the learning process, research does not definitively indicate that gamification positively impacts a student's quality of response although it has been shown to motivate increased levels of participation for sustained periods (Hanus & Fox, 2015; Seaborn & Fels, 2015). This resulting stamina may be attributed in part to a game's built-in ability to restart a level or task thereby making mistakes in the learning process temporary and easily recoverable (Hanus & Fox, 2015).

Secondary to academic performance, motivation is a critical component of engagement, persistence to the task, and skill retention (Looyestyn et al., 2017). Students participating in rote learning tasks often lack motivation, engagement, and willingness to persist in the task (Yoke

Seng et al., 2015). If the program components are educational, an otherwise undesired task such as solving math word problems or rapidly reciting addition facts might become more motivating in a gamified environment (Yoke Seng et al., 2015). If such behavior results in extended participation and engagement in the learning task, then the strategy is worth implementing. To further encourage higher levels of motivation and engagement, customized and individualized feedback can be provided by a gamified program to all program users simultaneously (Goodwin & Miller, 2013; Hanus & Fox, 2015; Raymer, 2011; Simoes et al., 2013).

Criticisms. Gamification is not, however, a perfect solution to student engagement and success needs. In contrast to the more voluntary and entertainment-based purposes for gaming, gamification in education is the application of gaming elements within the nongame context of instruction (Seaborn & Fels, 2015). Seaborn and Fels (2015) discussed this distinction between gaming and gamification as a potential limitation to the effectiveness of gamification as an instructional strategy because, by definition, gamification of a nongame activity means that the activity only looks and feels like a game but is not truly a game. Nicholson (2013) conducted a study to test various nondigital gamification strategies including rewards, a leaderboard, individualized learning plans, superimposed narratives (i.e., the class was set up as if the teacher was a mad scientist and the students were lab rats attempting to escape the maze of their syllabus), and point acquisition. The results were not entirely positive. After implementing a points system, overlaid narratives, and a leaderboard, he determined that students responded well to the autonomy that gamification provided but struggled with the relevance and application (Nicholson, 2013). He found that rewards and leaderboards catered to students who were motivated by public success, but some students lost motivation once they developed a perception that they could not succeed (Nicholson, 2013). He also found that narratives could be engaging if

they were relevant and point acquisition was beneficial for those who needed external rewards (Nicholson, 2013). In all, self-determination theory (Deci & Ryan, 2004) continued to be an applicable theoretical framework. Students also demonstrated a need for autonomy, competence/self-efficacy and recognition/relatedness to be successful (Deci & Ryan, 2000).

Despite the many benefits of technology and gaming in education, user dependence or technology addiction (Posey Norris & Altevogt, 2015; Weale, 2015), overexposure to digital media (Clough et al., 2013), teacher buy-in (Marti-Parreno et al., 2016) and eventual user boredom (Yoke Seng et al., 2015) are all significant criticisms of instructional technology application. To address many of these criticisms, adopting a program that aligns with an appropriate theoretical framework makes integrating the program more relevant and effective. Application of the major constructs of self-determination theory through a gamified platform includes a motivating storyline through a sequence of increasingly more challenging levels with seamless integration of other gamified components (Kapp, 2012a). In conjunction together, these gamified components can motivate program participants and maintain interest while reducing boredom or rates of dropout (Yoke Seng et al., 2015).

Many teachers voice concerns regarding the widespread technology integration focus in all areas of content instruction (Marti-Parreno et al., 2016; Shade & Watson, 1990). Mathematics related anxiety carries significant implications for in-service teachers and is considered pre-existing by the time the teacher enters the classroom (Tatar et al., 2015). Exposure to technology-integrated mathematics instruction training is then most beneficial while a teacher is still preservice as some of the anxiety towards mathematics may be avoided (Abbitt, 2011; Tatar et al., 2015). When this training is not provided before a teacher begins his or her professional career, the habits already formed may have a negative impact on future students' perception and

progress in mathematics, thus perpetuating the feelings of anxiety and negative perceptions (Tatar et al., 2015). Furthermore, a lack of suitable technology resources, infrastructure issues, and insufficient funding are all significant concerns necessitating careful evaluation of cost effectiveness and expected benefits before a purchase is made (Craig, 2000). Jung and Conderman (2015) suggested that most technology-integrated mathematics lessons have both a high-tech and a low-tech option giving teachers some flexibility in selecting and implementing technology despite funding restrictions.

Technology as an instructional tool can be exceptionally beneficial and effective for learning or just as easily misused (Shade & Watson, 1990). Some teachers may worry that technology implementation will add to their overall workload without replacing other tasks (Shade & Watson, 1990). Other teachers worry that technology has the power to minimize other classroom activities (Shade & Watson, 1990). Technology acceptance (Laver, George, Ratcliffe, & Crotty, 2012) is a necessary component of effective technology integration. In support, research shows that technology, when effectively implemented, is more likely to support learning and build on other related academic experiences by augmenting, and not replacing, the existing classroom activities (Jung & Conderman, 2015; NAEYC, 1996). Some changes in instructional settings derived from technology-based mathematics including distance or flipped education may provide students with an inappropriate level of freedom and flexibility that results in lower skill retention and decreased completion rates (Carr, 2000). To address this concern, Kinney and Robertson (2003) recommend that schools poll their students for input on their personal interests and perceptions to learning before placing students in a technology-rich environment that may not be suitable to their learning style. Although the purpose of the integration of a new instructional strategy is to positively impact student performance positively, some researchers

contend that the expectations of true instructional technology integration may represent utopian ideals and spout prescriptive formulas for student motivation that gamification cannot deliver to the levels anticipated (Chang, 2013; Kapp, 2012b; Lawley, 2012; Seaborn & Fels, 2015).

Strengths/weaknesses of literature and need for present study. Many studies (Guay et al., 2010; Kanat-Maymon, Benjamin, Stavsky, Shoshani, & Roth, 2015; Reeve & Lee, 2014), derived from varying perspectives and applications of self-determination theory, offer a different view of student motivation and its impact on engagement, satisfaction, self-efficacy, and overall academic achievement. A parametric case study looked to compare the effects of gamification on students' interest level, motivation, behavior, and ultimately academic performance (Pedro et al., 2015). More specifically, the study investigated the connection between gamification and student behavior and achievement, hypothesizing that a correlation could be identified between using a gamified program and improving academic achievement while increasing student engagement as indicated by a documented decrease in student misbehaviors (Pedro et al., 2015). The results of this parametric case study were inconclusive. Although the study did not initially intend to identify gender as a variable, the results of the case study indicated a difference in response between males and females (Pedro et al., 2015). While males responded more positively to gamification and showed an increase in motivation with a decrease in misbehaviors, gamification did not show any impact on behavior or engagement with the female participants (Pedro et al., 2015). The study also concluded that the correlation between gamification and motivation as measured by the prevention of student misbehaviors was inadequate and would require additional research (Pedro et al., 2015).

What these and other studies do not explore, however, is the connection between gamification as a specific instructional strategy and students' levels and directions of motivation.

Furthermore, existing studies such as that by Gillet et al. (2012) identify diminishing motivation as students increase in age and grade level, but such a conclusion cannot be left unaddressed. Education is a dynamic field, continually adapting to advancing research regarding technology integration (Hanover Research, 2013) and as such must address this apparent deficiency. With the 21st century learner becoming more and more technologically proficient and dependent (Hanover Research, 2013), a study of the impact of such technology integration upon student motivation is necessary. Although some studies like the one referenced above by Gillet et al. (2012) used instruments like the Intrinsic and Extrinsic Orientation Scale (Harter, 1981), Ryan and Deci (2000) suggested that the most common approach to measuring levels of intrinsic motivation is through activity-specific self-reports that indicate individual interest and enjoyment. The researcher of the current study decided to use one-on-one phenomenological interviews. The interview instrument developed by the researcher was used to determine student motivation toward gamified mathematics instructional programs in an attempt to explore self-determination theory as it applies to the specific context of gamified digital mathematics instructional programs.

Theoretical Framework

Philosophers, in the observation of human behavior, originally sought to describe motivation through the existence of drive. Freud (1914) and Hull (1943) each developed a version of drive theory consisting of the idea that specific, natural drives prompt or propel behavior. Skinner's (1953) operant conditioning theory connected all actions and behaviors to the rewards offered beyond and independent of the task itself. As research progressed and related theories continued to be developed and refined, drive theories, although helpful in understanding some components of human behavior, were not capable of adequately addressing all components

of human behavior. Operant conditioning theory, for example, could not explain an individual's reason for completing an activity without the promise of an external reward (Elliot & Covington, 2001; Skinner, 1953). Actions or decisions that are made without fulfilling a drive are not explained by drive theories leading to the concept of intrinsic motivations, or motivation that exists beyond the satisfaction of a drive (White, 1959).

Human motivation. Within the study of human behavior, motivation is the theoretical construct that represents the reasons and rationale governing behavior (Deci & Ryan, 1985). Various theories regarding human motivation attempt to identify, define, and understand the reasons and rationale governing behavior, specifically as it relates to an individual's actions, decisions, desires, and needs (Deci & Ryan, 1985; Elliot & Covington, 2001). Human motivation is comprised of two fundamentals: energy and direction (Deci & Ryan, 1985). While energy refers to needs that are critical to the existence and wellbeing of an individual, direction refers to the process by which internal and external stimuli are interpreted (Deci & Ryan, 1985). These internal and external motivators guide the individual towards the fulfillment of needs (Deci & Ryan, 1985). The impact of a motivator effectively prompts an individual to either repeat a behavior or avoid a behavior according to the response that behavior elicits (Elliot & Covington, 2001).

Human motivation theories are comprised of various meta-theories and then further into minor theories in an exploration of human behavior and assumptions related to motivation (Deci & Ryan, 1985). Such variance results in theories that are either mechanistic, presuming that individuals are passive and driven by external and environmental stimuli, or organismic, presuming that individuals actively initiate the behaviors they exhibit (Deci & Ryan, 1985). With specific attention to the role of stimuli within each minor theory of motivation, passive

organisms require stimuli to stimulate behavior in a causal relationship as contrasted with active organisms that utilize and manipulate stimuli to satisfy their own needs (Deci & Ryan, 1985). Human motivation is further categorized by the types of human drive explored within the theory (Reiss, 2012). Theories that explore human drive within the context of intrinsic versus extrinsic are categorized as dualistic theories (Reiss, 2012).

Incentive theory. Incentive theory is a specific example of human motivation theories which asserts that behavior is extrinsically motivated through a need for reinforcement or incentives (Hockenbury & Hockenbury, 2011). Incentive theory explores the relationship between extrinsic motivation (i.e., the "pull" individuals experience by an external stimulus) and intrinsic motivation (i.e., the internal "push" towards a particular behavior; Hockenbury & Hockenbury, 2011). Incentive theory is similar to drive theories in that behavior is motivated by the "pull" of external stimuli or motivators (Hockenbury & Hockenbury, 2011). Within the context of gamification, external motivators would include receiving recognition for progress (Raymer, 2011), rewards, money/points, "losing a life," ranking boards, and earning or losing items (Hockenbury & Hockenbury, 2011). Similar to the constructs of operant conditioning theory, the reward received (either positive or negative) has a direct impact on the behavior and the predictability of the behavior repeating (Cherry, 2018). Unlike operant conditioning theory, the reward may be intangible or internal in the example of a self-imposed goal or performance level (Hockenbury & Hockenbury, 2011).

Incentives are powerful but limited. Incentives can be used to initiate a behavior, sustain a behavior, or cease a behavior but are only as effective as the value the individual places, sometimes arbitrarily, upon that reward (Cherry, 2018). Furthermore, the reward must be realistic and attainable, or the individual may become frustrated and disinterested with the

reward (Cherry, 2018). Incentives are also problematic in that an individual is presumed to be passive and thus entirely motivated by the temptation of the reward or avoidance of the consequence (Deci & Flaste, 1996). Within such a context, a lack of motivation would indicate a lack of significantly compelling rewards (Deci & Flaste, 1996). Furthermore, such a passive approach fails to explain the natural curiosity and desire to learn that young children exhibit before and without any promise of rewards (Deci & Flaste, 1996).

Researchers and educators should carefully consider the impact a focus on external rewards may have on a student's level of intrinsic motivation. Extrinsic rewards that are not anticipated do not diminish an individual's level of intrinsic motivation (Cherry, 2018), which, in the context of gamification, would include unexpected "level ups" or random recognitions within the program (Raymer, 2011). Praise and constructive feedback increase an individual's internal level of motivation (Cherry, 2018) and ultimately encourage greater levels of engagement (Simoes et al., 2013). Since gamification is designed to provide extensive feedback (Hanus & Fox, 2015; Raymer, 2011) generalized to the strengths or areas of growth demonstrated by the user, program users might experience a similar increase in motivation. Intrinsic motivation is at risk for decreasing when external rewards or recognitions are given for completing basic or menial tasks (Cherry, 2018). Furthermore, research would indicate that external incentives could result in an overall decrease in response to the extrinsic motivator and reduction of intrinsic motivation (Lepper, Greene, & Nisbet, 1973). The juxtaposition between the benefits and potential downfalls of gamification should cause educators to carefully evaluate a prospective digital program for the anticipated contribution to building student motivation and engagement (Cherry, 2018). Doing so can help avoid a situation where the program interferes with or debases the instruction and learning intended to occur (Cherry, 2018).

Looking at incentive theory as a specific theory of motivation, the incentive is promised in advance and then presented after the behavior occurs in an effort to modify or reinforce the behavior. The immanence of the reward is directly correlated to the strength of the effect (Rani & Kumar-Lenka, 2012). A benefit of gamification is that rewards and reinforcement, both positive and negative, are delivered immediately in response to the participant's behaviors and progress within the program. Knowing that this strength of gamification is also a necessary requirement of incentive theory, a study of the impact of such an instructional strategy upon motivation is both logical and necessary.

Self-determination theory. Many theories regarding human motivation, such as the previously discussed incentive theory, adopt a unitary approach by assuming that motivation can be linearly measured by the amount resulting in overall motivation (Deci & Ryan, 2008). Self-determination theory takes human motivation to a deeper level by differentiating between types and quality of motivation in a way that other human behavior theories do not address (Deci & Ryan, 2008). With this different approach, self-determination theory allows for human behavior to be described in terms of a combination of intrinsic and extrinsic motivators and the differing degree to which those motivators impact human behavior (Deci & Ryan, 2008). From the observation that motivation can be impacted by unique combinations of intrinsic and extrinsic motivators, self-determination theory was developed (Deci & Ryan, 2008).

Initial development of self-determination theory began in the 1970s with an official release of the theory in the mid-1980s (Deci & Ryan, 1985). From that initial point of development combined with the application of self-determination theory within largely applied fields such as education, sports, and healthcare (Deci & Ryan, 2008), self-determination theory has continued to evolve. Current versions of the theory provide two comprehensive constructs:

autonomous motivation and controlled motivation (Deci & Ryan, 2008). Autonomous motivation involves a combination of intrinsic motivators and extrinsic motivators that have been assimilated to an individual's core values or belief systems. Controlled motivation involves fully external regulation by other individuals to control behavior as well as introjected regulation whereby shame, approval, and ego are used as prompting or avoidance factors (Deci & Ryan, 2008). These constructs are being further applied and explored through research on subconscious processes (Levesque, Copeland, & Sutcliffe, 2008). Self-determination theory is in a constant state of research, testing, and expansion as other researchers develop and refine the theory through their studies (Deci & Ryan, 2008). Mindfulness is an area in which researchers have deepened the application of autonomous functioning (Brown & Ryan, 2003). The connection between self-determination theory, specifically autonomous motivation, and mindfulness has led to positive implications in psychological and behavioral wellbeing (Brown & Ryan, 2003). Some researchers are concerned that the process of developing self-regulation is draining to an individual (Deci & Ryan, 2008). In contrast, self-determination researchers are identifying and exploring a link between autonomous regulation and energy and vitality (Moller, Deci, & Ryan, 2006). As such, controlled motivation is depleting while autonomous motivation is energizing (Moller et al., 2006).

The difference between autonomous motivation and controlled motivation with its particular contributions by intrinsic and extrinsic motivators is wide and varied (Deci & Ryan, 2008). Self-determination is built on the premise that human behavior is motivated by a need to satisfy three major constructs: autonomy, competence/self-efficacy, and recognition/relatedness (Deci & Ryan, 1985, 2008). The satisfaction of those needs contributes to the development of a motivation continuum that ranges from strictly amotivated to intrinsically motivated with several

subtypes of motivation falling along the continuum (Deci & Ryan, 1985, 2000). On the most extreme left side of the continuum, amotivation features nonregulatory behavior where the individual does not demonstrate value, competence, or control for any behavior (Ryan & Deci, 2000). Progressing toward the center of the continuum, extrinsic motivation includes external regulation, introjected regulation, identified regulation, and integrated regulation (Ryan & Deci, 2000). External regulation is an extrinsic motivation whereby an individual's behavior is stimulated by an attempt to demonstrate compliance, avoid punishments, or receive rewards (Ryan & Deci, 2000). Introjected regulation features behavior that is extrinsic but involves self-directed internal rewards and punishments (Ryan & Deci, 2000). Identified regulation becomes more intrinsic in nature and relies on the values and beliefs and individual superimposes on a task to establish importance (Ryan & Deci, 2000). Integrated regulation makes the transition between extrinsic motivation and intrinsic motivation by prompting an individual to behave in such a way that demonstrates self-awareness and alignment with his or her value system (Ryan & Deci, 2000). Interest and enjoyment lead to intrinsic regulation which forms the most intrinsic side of the self-determination continuum (Ryan & Deci, 2000). It is in this state that an individual is considered to be self-determined (Ryan & Deci, 2000). This continuum of extrinsic to intrinsic motivation with each subtype (Deci & Ryan, 1985, 2000) formed the basis of the current study's research questions. The interview instrument used in this study addressed the subtypes of motivation discussed by self-determination theory.

Self-determination theory (Deci & Ryan, 1985) is a dualistic macro theory within human behavior motivation theories and focuses on the satisfaction of three main psychological needs: autonomy, self-efficacy/competence, and recognition/relatedness. Whereas many other theories regarding human motivation focus on the development and relative strength, order, or priority of

a set of human needs, self-determination theory focuses on self-efficacy/competence, recognition/relatedness, and autonomy as basic and universal needs (Deci & Ryan, 2008). Being dualistic, self-determination theory allows motivators to be either extrinsic, behavior is based on rewards, or intrinsic, behavior is stimulated from within (Ryan & Deci, 2000). The three psychological needs addressed in self-determination theory impact motivation which then impacts an individual's level of persistence and performance (Van Nuland, Taris, Boekaerts, & Martens, 2012). Gamification requires individuals to manipulate and interact within the presented environment to satisfy needs for recognition/relatedness (Raymer, 2011), self-efficacy/competence, and autonomy.

Autonomy. Individuals demonstrate a psychological need to experience control over a situation (Ryan & Deci, 2000). Such control is addressed in self-determination theory as autonomy or the ability to self-determine a sequence of events or actions (Van Nuland et al., 2012). High levels of autonomy may lead to lower levels of intrinsic motivation while low perceptions of autonomy may increase intrinsic motivation (Van Nuland et al., 2012). Although initially contradictory to the constructs presented in self-determination theory (Ryan & Deci, 2000), the relationship between autonomy and motivation may be related to whether or not the content presents a challenge to the individual (Van Nuland et al., 2012). Individuals are motivated by a challenge that requires effort but is still manageable in scope (Posey Norris & Altevogt, 2015; Simoes et al., 2013). Such challenges give the individual a feeling of self-determination because the power to succeed is literally dependent upon their intrinsic motivation to complete the task (Posey Norris & Altevogt, 2015).

Self-efficacy/competence. The second psychological need addressed by self-determination theory is an individual's need to appear competent (Ryan & Deci, 2000). The

more competence an individual perceives to demonstrate, the more persistence that individual tends to devote to the task (Van Nuland et al., 2012). This persistence is driven by the idea that confidence in a task leads to greater levels of enjoyment which results in the desire to continue with the task (Van Nuland et al., 2012).

Recognition/relatedness. An individual experiences recognition through the perception of social relatedness (Ryan & Deci, 2000). Within a classroom setting, such recognition exists among peers and with the teacher through a sense of belonging to the group and a connection with others in the classroom (Van Nuland et al., 2012). An individual who experiences greater perceptions of relatedness may also experience more confidence to safely explore an unfamiliar task (Van Nuland et al., 2012). A classroom environment that provides recognition and reinforcement is instrumental in building motivation (Huffman, Adamopoulos, Murdock, Cole, & McDermid, 2011). Gamification provides ample opportunity for recognition through community building and customized, constructive feedback (Raymer, 2011; Simoes et al., 2013).

Mini-theories within self-determination theory. As self-determination theory has continued to be developed and refined, additional mini-theories have been developed to provide a deeper understanding of the varying degrees of interaction between intrinsic motivators and extrinsic motivators. Specifically, six mini-theories within self-determination theory address various phenomenon that impact motivation: cognitive evaluation theory, organismic integration theory, causality orientations theory, basic psychological needs theory, goal contents theory, and relationships motivation theory. Cognitive evaluation theory involves intrinsic motivation that can be enabled or undermined based on social and environmental factors (Deci & Ryan, 2000). Within cognitive evaluation theory, autonomy and self-determination are critical factors in achieving higher levels of intrinsic motivation (Deci & Ryan, 2000). Organismic integration

theory addresses the level or degree to which an individual internalizes an extrinsic motivator (Deci & Ryan, 2000). If an individual can get to a point of fully integrating the relevance and value as his or her own, the behavior could evolve into autonomous choice despite the original extrinsic nature of the motivator (Deci & Ryan, 2000). Causality orientation theory then focuses on an individual's orientation towards an environment, either autonomous, controlled, or amotivated, and how that orientation impacts behavior regulation (Deci & Ryan, 2000). Basic psychological needs theory focuses on the three basic needs proposed by self-determination theory: autonomy, competence/self-efficacy, and relatedness/recognition (Deci & Ryan, 2000). The theory clarifies that all three needs are fundamental and universal psychological needs (Deci & Ryan, 2000, 2008). Deci and Ryan (2008) asserted that autonomy, competence/self-efficacy, and relatedness/recognition relate to overall health and well-being (Deci & Ryan, 2000). Goal contents theory connects intrinsic and extrinsic motivation to goal-setting (Deci & Ryan, 2000). The achievement of those goals contributes to overall feelings of satisfaction (Deci & Ryan, 2000). Relationships motivation theory explores the contribution of all forms of relationships to fulfill a basic need for belonging (Deci & Ryan, 2000) The relationships motivation theory acknowledges an individual's need for relatedness as well as to experience feelings of competence and autonomy (Deci & Ryan, 2000).

Theory application. Self-determination theory, particularly the self-determination continuum of motivators (Deci & Ryan, 1985, 2000), was used as the theoretical framework for this study. Based on the constructs of autonomy, competence/self-efficacy, and recognition/relatedness, intrinsic and extrinsic motivation were the two determinants used to guide the formulation of this study's research questions and frame the study's findings. The semi-scripted interview questions were written in alignment to self-determination theory to

explore the types and subtypes of motivation proposed by the theory. Gamification utilizes a combination of intrinsic and extrinsic motivators to satisfy each of the three needs proposed by self-determination theory: autonomy, competence/self-efficacy, and recognition/relatedness (Reeve & Lee, 2014).

Student motivation is a universal consideration in classrooms regardless of student age in an attempt to engage and instruct students in the necessary education goals and objectives (Bedient, Scolari, & Kowalewski, 2003). As high-stakes testing and accountability remains the focus of education, educators have a unique challenge to maintain motivation (Bedient et al., 2003). Maintaining motivation can be difficult when unmotivating test preparation causes students to act passively which results in diminished motivation and reduced effort spent on learning (Bedient et al., 2003). When looking at student motivation across age groups, Gillet et al. (2012) explored a phenomenon in which motivation decreased in a clear, linear pattern as students progressed in age and through grade levels. Ryan and Deci (2000) determined that level of motivation is dependent upon the individual's interest in the activity leading to the conclusion that a decrease in motivation in school-age children corresponds to a similar decrease in interest with school-related activities.

Student motivation is variable and dependent on individualized characteristics (Deci & Ryan, 2008). Typically, 21st century learners compartmentalize their lives requiring them to prioritize and budget their time (Sedden & Clark, 2016). This behavior causes individuals to devote a minimal amount of time, effort, and attention to a task before another activity captivates their interest and motivation (Sedden & Clark, 2016). As such, students are not motivated by busywork or irrelevant learning opportunities but must instead be able to quickly build relevance and importance for a task before being motivated to complete the task (Sedden & Clark, 2016).

To address this need for educational relevance, instructors should be continually prepared to help students make connections to the academic content (Sedden & Clark, 2016). Likewise, teachers need to be prepared to remind students of their learning goals, specifically pertaining to how the content will enable the student to achieve their own personal and professional goals (Sedden & Clark, 2016). Such connections may be better made through implementation and integration of meaningful instructional technology pending the teachers possess necessary skills (Abbitt, 2011) and attitudes conducive to promoting high levels of student approval (Laver et al., 2012).

Although all individuals experience intrinsic motivation, the varying level and direction of that motivation is dependent upon the relationship between the individual and the action (Ryan & Deci, 2000). This variance in degree of motivation is a unique construct of self-determination theory that differentiates it from other theories regarding motivation (Deci & Ryan, 2008). In particular, such a relationship directly relates to the individual's interest and prior experience with the action (Ryan & Deci, 2000). When an individual experiences interest in a behavior or activity, extrinsic motivators can build motivation and not adversely affect the level of motivation (Hockenbury & Hockenbury, 2011). For example, in a gamified environment, rewards may be promised before an action is required resulting in a strictly extrinsic motivator (Skinner, 1953). Alternatively, rewards can be unanticipated requiring individuals to demonstrate intrinsic motivation within the program without the promise of a reward (Hockenbury & Hockenbury, 2011). The attitudes and framework established by the environment and dictated by the individual controlling the environment directly impacts the student's ability to self-motivate (Deci & Flaste, 1996).

Impact of motivation upon achievement. Motivation, as it relates to education, is a necessary prerequisite for acquiring new skills, performing educational tasks, implementing

strategies, and modifying behaviors (Taheri et al., 2015). Many factors that impact or affect student motivation, either positively or negatively. Desire and interest in the subject material are two such factors that can substantially increase student motivation (Sedden & Clark, 2016). Specifically, motivation toward educational achievement is most likely to occur when a student achieves appropriate academic performance and makes educational gains (Taheri et al., 2015). When educational gains do not occur, feelings of failure within a content area develop and may prompt the student to redirect motivational focus to a different content area where the student might experience educational progress and corresponding feelings of success (Taheri et al., 2015).

The classroom environment is a critical factor in determining and encouraging effective student motivation (Sedden & Clark, 2016). Classroom scheduling can either promote or discourage motivation with small group discussions frequently breaking up continuous chunks of lecture or direct instruction thereby keeping students engaged and focused throughout the course of the lesson (Sedden & Clark, 2016). Furthermore, clarity and organization provided by the instructor and including clear directions, addressing misunderstandings, and proactively working to avoid confusion promote a strong classroom-learning environment supportive of student motivation and engagement (Sedden & Clark, 2016). Other environmental factors can have a positive effect on student motivation such as the existence of natural green space offering a respite to students and providing a motivating environment for study, reflection, and learning (Taheri et al., 2015).

Intrinsic motivators positively impact learning, performance, and enjoyment while extrinsic motivators run the risk of potentially undermining the learning goals and adversely impacting overall motivation (Gillet et al., 2012). A study by Huffman et al. (2011) compared

three distinct motivators including both intrinsic and extrinsic forms of motivation. In a university setting where a standardized test was a requirement for graduation, the researchers studied the impact of a motivational presentation, monetary incentive, or no incentive beyond academic performance on test score improvement (Huffman et al., 2011). The study determined that recognizing student effort, encouraging performance, and building relevance for the students exhibited a positive effect on the students resulting in increased student motivation and higher test scores (Huffman et al., 2011). Such results would further support suppositions that intrinsic motivators such as self-efficacy, relevance, and recognition have a greater impact on student performance and a greater likelihood to perform at academic ability levels than extrinsic motivators or absence of any motivational strategy as an intervention, which prompted lower than expected ability performance levels (Huffman et al., 2011). Further, when teachers push performance-related goals, students' interest and ultimately motivation decreased (Wigfield et al., 1998). Whereas external motivators such as rewards, compulsion, and excessive praise may inhibit long-term motivation in isolation when such strategies are coupled with high levels of intrinsic motivation, engagement results are maximized (Hayenga & Corpus, 2010).

In contrast to the negative effects of the use of extrinsic motivators, learning environments where the students are an active part of the learning process are more impactful (Sedden & Clark, 2016). In these environments, students are connected to their own learning and exhibit signs of self-efficacy (Sedden & Clark, 2016). In situations where the instructors and students have built meaningful relationships leading to greater levels of trust and respect, the demonstrated willingness on the part of the instructor to support student autonomy resulted in motivated students who were confident that their instructor was personally invested in the learning process and committed to academic success (Sedden & Clark, 2016). Furthermore,

opportunities, where the students could be a part of the decision-making process, encouraged them to develop a sense of responsibility and demonstrate independence (Sedden & Clark, 2016). Achieving a level of high student motivation can be considered as important or as successful as achieving a high level of student achievement because of the correlation and dependence between the two (Taheri et al., 2015).

In addition to factors such as classroom environment and teachers' instructional practices (Abbitt, 2011) positively impacting students' motivation, technology embedded instructional strategies such as games, blogging, instant response, and multimedia also demonstrate a positive impact on student learning (Lumpkin et al., 2015). Although effective technology is shown to have an impact on student motivation, educators, not aware or unwilling to recognize its impact on motivation, may be reluctant to implement technologically based motivational strategies as a critical instructional method (Riedel, 2014). For example, in a study by Lumpkin et al. (2015), over 80% of undergraduate and graduate students reported that the technology based instructional strategies used by their instructors increased motivation and positively impacted the learning experience. Malm and Defranco (2012) summarized the students' perspectives and expectations by pointing out the difference between when technology is used and how technology is used to enhance education. Through this understanding, technology can be viewed as the facilitator by which students may become actively engaged in the content rendering technology integration as a critical component to educating 21st century learners (Lumpkin et al., 2015).

Whereas effective motivational strategies can positively impact student motivation, thereby increasing academic achievement, a lack of motivation can likewise negatively impact achievement levels. Such a lack of motivation can compromise the integrity of the program by

producing graduates not fully prepared for and engaged in their field of study (Taheri et al., 2015). Decreased motivation can also cost schools and universities monetarily by requiring additional resources and time to adequately reach, motivate, engage, and ultimately educate the students served by the program (Taheri et al., 2015).

Despite the known correlation between the environment of the classroom, the enthusiasm and engagement of the teacher, and the importance of strong and impactful motivation strategies within the learning environment, teachers may not fully comprehend or might underestimate their own contributions to encouraging or discouraging student motivation (Taheri et al., 2015). For some students, the product of education is more motivating and satisfying than the process of learning (Sedden & Clark, 2016). Such a focus on post-graduation motivators impacting educational decisions was further substantiated by a study of students at Guilan University within the College of Medical Sciences. Including over 300 qualifying students in the attempt to identify strategies and/or factors that improve educational achievement motivation (Taheri et al., 2015), this study concluded that the single greatest economic factor for motivating students to complete their program of study was the hope for a better job post-graduation (Taheri et al., 2015). Effectiveness and efficiency along with value and respect also demonstrated a significant impact on student motivation as self-reported on the survey (Taheri et al., 2015). Kanat-Maymon et al. (2015) applied the principles of self-determination theory and determined that students who were more likely to cheat on academic assignments indicated frustration versus satisfaction. Furthermore, the students' perceived levels of fulfillment from learning demonstrated a positive association with autonomy and motivation leading to an inverse relationship with academy dishonesty (Kanat-Maymon et al., 2015). This focus on motivation differed greatly from the teachers' perceived motivators. The difference resulted in a disconnect between motivational

strategies and effective strategies (Kanat-Maymon et al., 2015). Ultimately, teachers tended to place a disproportionate level of emphasis on extrinsic motivation over intrinsic motivation which opposes research and motivational theory leading to an obvious disconnect between the strategies teachers may employ to motivate students and the strategies that actually stimulate student motivation (Wiesman, 2016).

Increasing student motivation. With a correlation between effective motivational strategies and academic achievement (Gillet et al., 2012), teachers must seek to understand what effectively motivates their students and then utilize those motivational tools to impact engagement and performance. Studies by Wigfield, Guthrie, Tonks, and Perencevich (2004) and Linnenbrink and Pintrich (2002) demonstrated that teachers could use engaging and interactive activities to create situational interest and ultimately increase students' levels of intrinsic motivation. These activities included investigations, cooperative activities, hands-on tasks, making relevant connections, and real-life applications (Linnenbrink & Pintrich, 2002; Wigfield et al., 2004). In alignment with one of the three major constructs of Deci and Ryan's (1985) self-determination theory, relatedness, Crumpton and Gregory (2011) determined that educators who meaningfully increased the relevancy of the material being taught saw a similar increase in student motivation leading to higher levels of student engagement. The connection between engagement and interest or relevancy is not a new connection (Looyestyn et al., 2017). Examples can be traced to the systematic establishment of an interactive classroom where students are provided relevant and meaningful practice in content material that connects with the students' interests and long-term goals (Sedden & Clark, 2016) thus building student motivation (Chin-Fei & Chia-Ju, 2012). Self-efficacy, another construct identified by self-determination theory (Deci

& Ryan, 1985) is positively impacted by gamification elements to increase student motivation (Banfield & Wilkerson, 2014).

Students are further motivated by the motivational behaviors of their teacher (Sedden & Clark, 2016). When a relationship exists between the student and the teacher, that relationship and the enthusiasm that the teacher shares with the class is more impactful on motivation than classroom management, the instructor's level of intellect, or the instructor's professional background and training (Sedden & Clark, 2016; Taheri et al., 2015). With this understanding, an educator can take intentional steps towards building a classroom culture that is positive, relevant, and facilitates meaningful interaction between the student and the teacher as well as opportunities for collaboration and interest-based learning (Sedden & Clark, 2016). Within a clinical setting, additional strategies to increase student motivation were identified and explored including social learning experiences, observations, frequent feedback, and instructors prepared to meet students' motivational needs (Sedden & Clark, 2016). Specific to instructor quality, those educators who gave direct guidance, connected theory with their instructional practice, were consistent and reliable, and open to questions or student needs effected greater involvement and motivation in their students (Sedden & Clark, 2016).

Deci and Ryan (1985) similarly stressed the need for prompt and quality feedback in self-determination theory. Such feedback is motivating to the learner but can be cumbersome for the teacher with dozens of students (Hanus & Fox, 2015). Instructors who implemented an "open door" policy with their students encouraged two-way communication, collaborative problem-solving, and involvement in the learning and feedback process allowing students to increase their own buy-in and relevance to the instructional environment (Sedden & Clark, 2016). Such opportunities for dialogue become a frequent and ongoing source of feedback as well as a

method to help otherwise distracted students with compartmentalized lives focus on the needs of the course content while connecting in a meaningful way with the instructor to address needs or reflect on progress (Sedden & Clark, 2016). Technology, likewise, can offer a virtual mode of providing meaningful dialogue in a timely manner through interactive discussion forums initiating collaboration, discussion, and debates (Hanus & Fox, 2015; Lumpkin et al., 2015; Raymer, 2011). With an emphasis on gamification, technology, and learning methodologies, Villagrasa, Fonseca, Redondo, and Duran (2014) worked to increase student motivation and engagement, specifically by encouraging student collaboration and integrating virtual reality platforms as a source of teacher support and student feedback. A positive relationship was determined between gamification components and student motivation and appreciation for the tasks demanded of them (Villagrasa et al., 2014). Interactive response methods such as clickers, polls, and online exit tickets provide students with near-instant feedback while allowing teachers to identify possible misconceptions, gauge overall and individualized levels of understanding, and ascertain those students who may be in need of additional assistance before resistance and frustration can have the opportunity to derail motivation and learning (Lumpkin et al., 2015).

Chapter Summary

Motivation has prompted the derivation of many different applications, meta-theories, and minor theories guiding countless research studies and articles from numerous perspectives. Many of these studies look for ways to make positive or negative connections and correlations between student motivation and any number of other concepts including classroom performance, behavior, achievement, and engagement. While a teacher might expend significant time and energy in an attempt to differentiate or scaffold instruction to each student’s level of readiness, gamified technology integrated into instruction can seamlessly individualize for skill level and

rate of mastery (Hanus & Fox, 2015). Appropriately designed technology programs can also provide leveled instruction and yield diagnostic information concerning performance levels (Yoke Seng et al., 2015). Research does not yet definitively indicate that gamification has a positive impact on a student's quality of response, but gamification has been shown to increase motivation leading to higher levels of participation over longer periods of time (Hanus & Fox, 2015; Seaborn & Fels, 2015).

The phenomenon of gamification, as a means to increase student motivation thereby increasing overall academic performance (Reeve & Lee, 2014), is well explained through self-determination theory (Deci & Ryan, 1985). Within the constructs of this theory, this study was designed to more thoroughly explore the impact of gamification as a motivational strategy and its subsequent effect on self-perceived levels of motivation. Furthermore, with careful consideration for self-determination theory (Deci & Ryan, 1985), extrinsic motivators, although an inherent part of gamification in the form of points and badges, should be limited while intrinsic motivators, including positive feelings of self-efficacy and playing for enjoyment should be the driving force behind game design (Ibanez et al., 2014; Seaborn & Fels, 2015). One-on-one phenomenological interviews were used to explore which gamified intrinsic and extrinsic motivators embedded within digital mathematics instructional programs contributed to self-reported levels of student motivation.

Chapter 3: Procedures and Methods

The purpose of this qualitative study was to identify how intrinsic and extrinsic motivators embedded within gamified digital mathematics instructional programs contribute to motivation levels of third- through fifth-grade students at an elementary school located in central Texas. To achieve the study's purpose, the following overarching research question was asked: To what extent and in what ways do gamified components embedded in an elementary-level digital mathematics instructional program contribute to students' motivation levels? From this overarching research question, the following research sub-questions were asked:

RQ1. Which extrinsic motivators embedded within an elementary-level digital mathematics instructional program contribute to student motivation?

RQ2. Which intrinsic motivators embedded within an elementary-level digital mathematics instructional program contribute to student motivation?

Chapter 3 includes discussions on the research design, the specific site selected for the study, and the population. A description of the participants and participant selection techniques are also discussed. Ethical issues and permissions are presented for review. Then, the researcher discusses the data sources, describes the research protocol and instrumentation, and discusses the data collection procedures. Additionally, the chapter includes discussions regarding the researcher's positionality and the issues related to trustworthiness and rigor. Further, the chapter contains a discussion of the data analysis techniques used in the study. Finally, the chapter concludes with a summary of the chapter's main ideas.

Research Design

When identifying a research topic and selecting the subsequent research model that best aligns to the purpose of the research, a comparison of the available research models is beneficial.

Quantitative and qualitative research designs carry different purposes, goals, methods, and perspectives (Johnson et al., 2007). A quantitative study produces data that are numerical in nature (Teddlie & Tashakkori, 2009). In contrast, a qualitative study produces data that are narrative in nature (Teddlie & Tashakkori, 2009). The process of interpreting and reporting each type of quantitative or qualitative data would, likewise, differ (Teddlie & Tashakkori, 2009). When discussing quantitative and qualitative research, Mahoney and Goertz stated, "Both approaches are of value; in fact, they complement one another" (Mahoney & Goertz, 2006, p. 231).

Self-determination theory is built on the idea that a combination of intrinsic and extrinsic motivators in varying combinations contribute to human motivation and behavior (Deci & Ryan, 2008). The unique combination of intrinsic and extrinsic motivators required to stimulate a response varies from individual to individual and from setting to setting (Deci & Ryan, 2008). As such, an interpretative phenomenological qualitative research design was selected to explore the complicated nature of motivation based on other research studies that utilized self-determination theory as the theoretical framework (Bolton & Dean, 2018; Lohmann, Muula, Houlfort, & De Allegri, 2018; Long, Readdy, & Raabe, 2014; Rosenkranz, Wang, & Hu, 2015).

Qualitative research endeavors to create or establish an understanding of a phenomenon (or theory in motion) often asking "how" or "why" questions (McGill, 2017). In short, qualitative studies produce narratives containing words, behaviors, or images and look at the big picture idea to bring meaning to the whole of the situation (McGill, 2017). There are five types of qualitative methods used in research: narrative, phenomenological, grounded theory, ethnography, and case study (Creswell & Poth, 2018).

Narrative research helps tell a story (Teddlie & Tashakkori, 2009) by requiring that the researcher interpret the events and behaviors observed or documented within their social context (Moen, 2006). Phenomenological design takes the concept of a single narrative study and broadens the population to a larger pool of individuals to explore shared experiences focused on a particular phenomenon (Creswell & Poth, 2018). Grounded theory design is focused on the development of new theory from the data gathered from research participants (Creswell & Poth, 2018). Ethnography takes grounded theory a step further. Whereas grounded theory may utilize participants from a variety of environments that all experience a similar phenomenon, ethnography focuses on the experiences of a group sharing a specific culture (Creswell & Poth, 2018). Such a research design is characterized by immersion in the culture experiencing the phenomenon (Creswell & Poth, 2018). While ethnography seeks to examine how a specific culture works, a case study investigates a specific issue within a bounded system (Creswell & Poth, 2018).

Strengths of qualitative design. Qualitative researchers seek to understand phenomena in terms of cause and effect (Mahoney & Goertz, 2006). As such, a smaller population is typically utilized to deepen the quality of individual contributions (Mahoney & Goertz, 2006). The smaller population sizes tend to lead to an analysis of causation instead of a correlation as in quantitative research (Mahoney & Goertz, 2006). Qualitative researchers are interested in the gathering, analyzing, organizing, and presenting of narrative information through the constructivism view warranting a first- or second-person voice to best present the narratives collected (Teddlie & Tashakkori, 2009).

Weaknesses of qualitative design. Qualitative designs are generally met with skepticism as to their statistical application (Mahoney & Goertz, 2006). With different definitions and

determinations for causation with each quantitative and qualitative applications, the findings from qualitative studies further experience mixed reactions (Mahoney & Goertz, 2006). The researcher must ensure that the research problem presented by the study is best explored through a phenomenological approach or another design should be considered (Creswell & Poth, 2018). To this end, the phenomenon under investigation must be one that a group of individuals share in order to develop a more thorough understanding of the phenomenon (Creswell & Poth, 2018). Identifying an appropriate population for the study may be difficult depending upon the phenomenon under review (Creswell & Poth, 2018). The analysis and corresponding determination of causation are typically narrowed to a limited field of application due to the limiting of population sizes and specificity of the theoretical framework (Mahoney & Goertz, 2006).

Interpretative phenomenological qualitative design. This study utilized a particular subtype of qualitative methods known as interpretative phenomenological qualitative design. Phenomenological design typically consists of interviews, which also remain the predominant data source for qualitative research (Bevan, 2014). Interviews effectively protect a participant's voice, perspective, and personal experiences (Bevan, 2014; Simpson & Quigley, 2016) assuming that the researcher mitigates his or her personal experiences and background knowledge (Creswell & Poth, 2018). From a perspective where the researcher is the author, the constructivist approach demands that the voice of the study participants remains intact and obvious throughout the data analysis process (Mills, Bonner, & Francis, 2006). The voice of the participant is critical to understanding the identity and perspective that the participant embodies (Simpson & Quigley, 2016). When intertwined with the researcher's view, these scripts then

contribute to the development of theory from the interpretation of such voices (Mills et al., 2006).

Descriptive and interpretative are two of the main interviewing methods used with other hybrid structures (Bevan, 2014). During phenomenological interviews, the role of the researcher within the phenomenological approach is critical (Bevan, 2014). The researcher can provide context or background content prior to beginning the interview (Colaizzi, 1978). Giorgi (1985) provided a two-part interview structure whereby descriptive contexts are first derived and then followed by questioning to deepen the understanding. Alternatively, the researcher can take an approach called "deliberate naiveté" whereby the participant shares life experiences about specific situations subject to the respondents' interpretations (Kvale & Brinkmann, 2009). From whatever approach the researcher may take, phenomenology gives the researchers a deeper understanding of a phenomenon by combining the contributions of multiple individuals into a collective understanding (Creswell & Poth, 2018). This study utilized an interpretative approach to balance phenomenological narrative with the researcher's interpretation of those findings (Bevan, 2014).

Strengths of interpretative phenomenological qualitative design. Phenomenological studies resolve to explore a phenomenon through the lens of human experience (Creswell, 2014). In interpretative research, the researcher engages in a complex and lengthy interaction with participants to delve deeply into the topic (Creswell, 2014). The interpretative phenomenological qualitative design, in particular, is dynamic and flexible according to the needs and responses of the participants (Gyllensten & Palmer, 2007) and is appropriate for investigating the meaning behind phenomenon-based experiences (Smith & Osborn, 2004).

Weaknesses of interpretative phenomenological qualitative design. Interpretative studies present several ethical and logistical issues within the research process (Lock, Spirduso, & Silverman, 2013). Researchers must be acutely aware and honest with themselves in identifying how positionality, bias, values, background, and other factors impact the interpretation of the findings (Creswell, 2014). Similarly, research involving the researcher's environment or work setting may compromise the integrity of the work (Glesne & Peshkin, 1992). To address these weaknesses, Creswell (2014) recommended that the study include clear and transparent statements to indicate prior relationships or connections between the researcher and the study participants. The researcher should then detail measures taken to ensure the integrity of the data including the use of an Institutional Review Board (IRB), the development of procedural steps to access the study site, and the identification of any potential risks to the participants (Creswell, 2014). For this study, the researcher did not use her home campus and selected another campus within the district where the researcher had never worked. Under IRB direction, the data producing sample was selected from the target research sample by removing all potential participants who might have had a prior relationship with the researcher. Bogdan and Biklen (1992) recommended that a draft proposal be submitted to the gatekeepers at the site before conducting the study. In compliance, the researcher met with the district deputy superintendent and the district math content specialist, provided them with a copy of the study proposal, and answered all questions related to ethics and permissions. These district gatekeepers and the University of West Florida IRB provided approval prior to the researcher conducting her work.

Methodological alignment to study purpose. The purpose of this qualitative study was to identify how intrinsic and extrinsic motivators embedded within gamified digital mathematics

instructional programs contribute to motivation levels of third- through fifth-grade students at an elementary school located in central Texas. Smith and Osborn (2004) recommended the interpretative phenomenological approach when topics are under-studied or new in the literature. Based on Smith and Osborn's (2004) recommendation and on the precedent set by other studies (Bolton & Dean, 2018; Lohmann et al., 2018; Long et al., 2014; Rosenkranz et al., 2015), an interpretative phenomenological qualitative design was selected to explore self-determination theory within the context of gamification in elementary digital mathematics instructional programs.

This study purposed to explore two primary phenomena: students' self-reported levels of intrinsic and extrinsic motivation and the depth to which those gamified factors impact students' motivation. The research questions proposed by this study directly addressed both phenomena. Student interviews provided depth and clarity. A phenomenological design is intended to describe the spirit of an observed phenomenon and is used when studying multiple individuals who share the same experience (Creswell & Poth, 2018). Furthermore, interviews are the primary source of phenomenological data which are then analyzed for significant themes (Creswell & Poth, 2018). Therefore, a phenomenological design was appropriate for this study because the researcher explored self-reported levels of motivation by elementary-aged students.

Justification for selecting interpretative phenomenological qualitative design. This study followed an interpretative phenomenological qualitative research design based on the utilization of qualitative methods by other studies grounded in self-determination theory to explore the phenomenon of motivation (Bolton & Dean, 2018; Lohmann et al., 2018; Long et al., 2014; Rosenkranz et al., 2015). The data collection phase of this study utilized Bevan's (2014) phenomenological structure to conduct the scripted portion of the interview process. This

structure is designed for interpretative phenomenological research and consists of three questioning types presented in a specific sequential order (Bevan, 2014). The three components of the structure, in order, are contextualize the phenomenon, apprehend the phenomenon, and then clarify the phenomenon (Bevan, 2014). This structure provides the researcher with the ability to set the context of the interview through descriptive and narrative questions, then explores the phenomenon under investigation through descriptive and structural questions, and finally resolves the interview with imaginative variation questions to clarify and extend the participant's view of the phenomenon (Bevan, 2014). Using this structure, the researcher developed scripted questions that were interspersed with unscripted derived in the moment to clarify, extend, or support a participant's responses to a scripted question.

Site Selection

An elementary school was selected as the study site. Schools provide researchers with a unique research environment to survey and interview children because research involving children are typically more cost-effective and more manageable in scope within the school system than in other settings (Gill et al., 2008). Upon receiving approval to conduct the study from the researcher's dissertation committee, the researcher contacted the district's deputy superintendent by email. The deputy superintendent researched district requirements and sent the researcher the administrative regulations guiding the approval process for conducting research (Appendix A). Based on administrative regulations for the district, the researcher completed the required form, submitted the form to the campus principal for approval, and then submitted the form to the deputy superintendent. The form was approved by all campus and district administrators.

The researcher then submitted a copy of her written research proposal to the deputy superintendent and the district's math content specialist. After this document was reviewed, a meeting was held with the district's deputy superintendent and math content specialist to discuss the researcher's needs, to answer questions, and to plan a preliminary schedule. The district's deputy superintendent and math content specialist gave approval to the researcher to conduct the research study. The researcher then worked with study site and district personnel to develop a tentative schedule that would meet the needs of the study while minimizing disruption to the campus environment. The researcher then collaborated with the principal of the study site to schedule the specific dates and times for the electronic survey to gather demographic information and the interviews that were suitable for both the researcher and the site. After scheduling the dates, the researcher scheduled personal days off with her employer. The researcher then made contact with the study site's computer lab teacher to discuss the researcher's needs and the process for the study. The researcher then communicated with all third-, fourth-, and fifth-grade teachers through a group email (Appendix B) to preview the scheduling needs. Once all site-based individuals affected by the study were contacted and a schedule was in place, the researcher proceeded with the study.

After establishing a collaborative working relationship with a local school district, an elementary school was selected based on the school's elective participation in a gamified and digitally delivered mathematics instructional program. Self-determination theory was not developed for any particular population and has been used in a wide variety of contexts and disciplines (e.g., healthcare, economic sales, survey response; Looyestyn et al., 2017) with varied populations, including middle school through college level students (Abramovich et al., 2013; Barata et al., 2013; Berkling & Thomas, 2013; Bolton & Dean, 2018; Charles et al., 2011; de-

Marcos et al., 2014; Dominguez et al., 2013; Gasland, 2011; Goehle, 2013; Haaranen et al., 2014; Hanus & Fox, 2015; Li et al., 2013; Lohmann et al., 2018; Long et al., 2014; Mayer & Johnson, 2010; McDaniel et al., 2012; Mekler et al., 2013a, 2013b; Meyer, 2008; O'Donovan et al., 2013; Rosenkranz et al., 2015; Silvernail & Lane, 2007; Turner et al., 2014). The site and subsequent population were selected based on the purpose of this study and its emphasis on elementary-aged students to address this study's problem. Based on the limitations of this study, an elementary school that served third through fifth grade was necessary.

The specific elementary school selected for study is located in a growing town directly west of the Dallas-Fort Worth, Texas, area. As one of five elementary schools and one of 10 campuses in the district, the school serves students from kindergarten through fifth grade. According to the 2016-2017 Texas Academic Performance Report, the school served 423 students representing three main ethnic populations including 1.2% African American, 21.3% Hispanic, and 73.5% Caucasian. The economically disadvantaged population represents 21.5% of the students (Texas Education Agency, 2018). Although this demographic information is no longer accurate due to the delay in the release of the report, the relative distribution of student subpopulations is assumed to be consistent from year to year. The school offers many individualized programs including English Language Learners, Gifted and Talented, and Special Programs. The school serves an at-risk population accounting for 21% of the student body. The students have an average attendance rate of 96.8% each day falling below the district's average attendance rate of 97.1% but above the state's average attendance rate of 95.8%. The site experiences a higher than average mobility rate of 12.5% when compared to 9% for the district (Texas Education Agency, 2018).

The school is served by a staff of 26.9 teachers, 4.3 professional support staff members, 5.9 educational aides, and two administrators with an overall average of 13.7 years of experience (Texas Education Agency, 2018). All of the teaching staff are considered "highly qualified" in compliance with the No Child Left Behind Act of 2001. According to the No Child Left Behind Act of 2001, a teacher must hold a minimum of a bachelor's degree, achieve full state certification, and demonstrate content specific competency in the subject area assigned to be considered "highly qualified" (p. 37). The overall student to teacher ratio is 15.7 students per teacher (Texas Education Agency, 2018). Many staff members have obtained additional endorsement certificates such as English as a Second Language, Gifted and Talented, Early Childhood, or Special Education (J. Choate, personal communication, May 21, 2018). The staff members regularly participate in professional development activities that integrate cross-curricular instruction, and all teachers are provided with staff development that includes training in differentiation strategies, specific strategies for English Language Learners, Fundamental 5, and Thinking Maps (J. Choate, personal communication, May 21, 2018). Also, specific attention is given to student achievement through balanced literacy, interactive technology, formal and informal assessments, and small group differentiated instruction (J. Choate, personal communication, May 21, 2018).

The study site can be described as a well-established and friendly learning community that promotes partnerships among all stakeholders (J. Choate, personal communication, May 21, 2018). The site environment values high instructional expectations and offers a wide variety of opportunities for students to expand their learning experiences (J. Choate, personal communication, May 21, 2018). The school district is supportive of and committed to the continuing education of its employees (A. Sadler, personal communication, October 17, 2017).

The district has developed and adopted a set of relevant administrative regulations which are presented in Appendix A. These administrative regulations outlined the district's participation in internship or research study opportunities and specified the procedure for obtaining permission from the hosting campus which is defined by the district, as the campus where the researcher is employed. The completed form was then submitted and retained by the Deputy Superintendent (Appendix C).

Population

Approximately 97% of school-age children currently engage in some form of video games and/or computer games enabled by 77% of American households providing personal gaming devices (Erenli, 2013). With a known correlation between video games and student motivation (Haskell, 2012), the integration of instructional technology has the potential to impact the school setting significantly. Between 80-98% of children in their teens encounter technology during the learning experience (Vosloo, 2014). Meanwhile, the age of the average digital game player is declining rapidly towards the age of children in elementary and secondary education (Johnson et al., 2013). Combining and applying these statistics yield an appropriate target population of students in upper elementary grades. Inclusion of third-, fourth-, and fifth-grade students in the study population was relevant to the existing trends in gaming because intervening early in the child's educational career can prevent mathematics anxiety and subsequent task avoidance from interfering with the learning process (Tatar et al., 2015).

The site selected for this study serves students in kindergarten through fifth grade. As this study was focused on students in upper elementary grades, the researcher considered the student populations of third, fourth, and fifth grade. During discussions with the study site principal to develop recruitment materials, the researcher was made aware that the site served approximately

100 students in each of the three target grade levels (J. Choate, personal communication, April 25, 2018). According to the 2016-2017 Texas Academic Performance Report for the entire district, the total third-grade population was 448 students, the total fourth-grade population was 445 students, and the total fifth-grade population was 406 students (Texas Education Agency, 2018). The study site is one of five elementary campuses in the district. Based on the study site principal's approximation of student enrollment and the overall reported student population in the grade levels participating in the research study, the study site and subsequent research population is typically sized for the district.

Description of Participants

Based on the information presented previously in this chapter, statistics and research indicated that gaming for educational and recreational purposes is increasing among a younger population (Erenli, 2013; Johnson et al., 2013; Vosloo, 2014). Additionally, research identified a correlation between video games and motivation (Haskell, 2012). An upper elementary-age population was selected for participation in this study. After identifying the study site, the researcher sent over 300 survey participation invitations containing parental consent forms home with potential participants. In response, 51 partial or complete consent packets were returned to the researcher. The researcher reviewed each consent packet for completion of all required documents and indicated eligible participants based on parent response. Parents could choose to (a) not return any documents indicating dissent, (b) return consent for the demographic survey only, (c) return consent for the survey and interview, or (d) return incomplete consent documents which the researcher filtered as non-consent. After the researcher filtered the returned consent documents, the researcher approached potential participants with assent documents for

participation in either the survey alone or the survey and interview. The following subsections will discuss the target research and data producing participants.

Target research sample. A target research sample was used to obtain a data producing sample. The researcher provided the target sample with an electronic survey that was used to determine whether respondents participated in a weekly computer math program. Forty respondents completed the survey containing demographic information. Two of the respondents acknowledged that they did not participate in a gamified mathematics instructional program at least once per week which made them ineligible to be included in the target research sample. Of the 38 qualifying survey participants, 45% were female, and 55% were male. The survey participants represented a range of ages including eight years old (7.5%), nine years old (47.5%), 10 years old (27.5%), and 11 years old (17.5%). Survey participants represented each of the three grade levels: third grade (42.5%), fourth grade (42.5%), and fifth grade (15%).

After completing the survey, survey participants were offered the opportunity to participate in the interview portion of the study. These survey participants were given the assent document to review. Of the 38 eligible interview participants comprising the target research sample, 17 participants were ineligible due to a prior relationship with the researcher. The IRB requirements restricted interview participants to individuals who did not have a prior relationship with the researcher. The 21 remaining survey participants met the data producing sample criteria; however, one survey participant was unavailable for a scheduled interview. In sum, the data producing sample consisted of 20 participants who were interviewed during the computer lab rotation schedule. A representation of this breakdown is included in Figure 2.

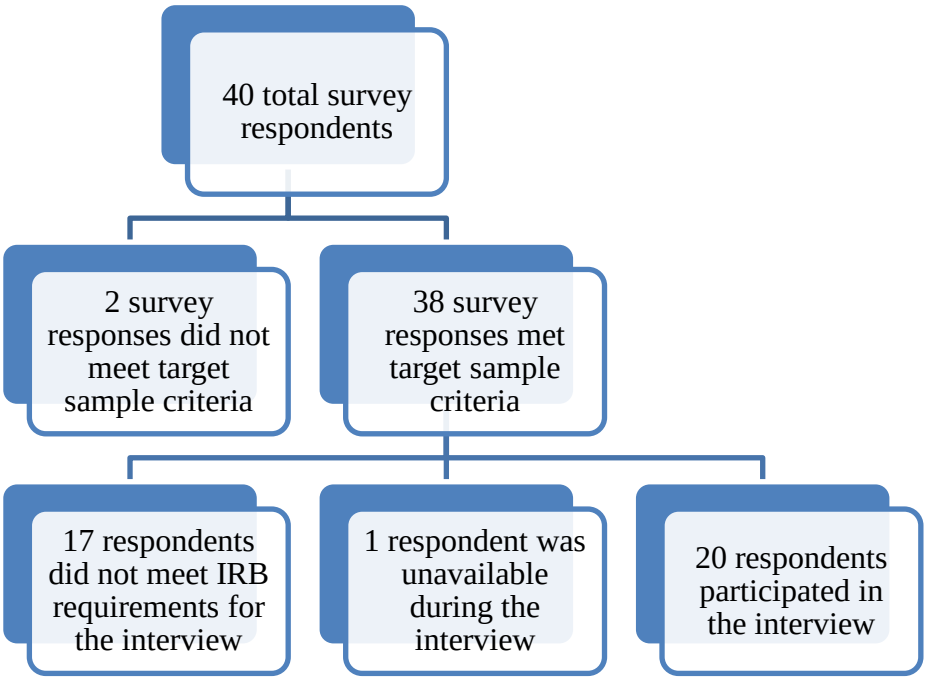

Figure 2. Selection of target research sample and data producing sample.

Data producing sample. During the data collection portion of the study, the researcher performed one-on-one interviews with 20 participants. Of these participants, 55% were female, and 45% were male. The data producing sample included participants from each of the grade levels: third grade (45%), fourth grade (40%), and fifth grade (15%). Participants were not queried for age during the interview because age was obtained during the survey phase. All data producing sample participants met the eligibility requirements set during the survey phase.

Participant Selection

Due to the fact that the researcher had a targeted population of approximately 300 students and no unobtrusive way to incentivize or recruit participants, she used convenience and purposeful sampling methods (Creswell, 2014). The researcher used convenience sampling to identify a target research sample. According to Creswell (2014), this sampling method is implemented when participants are selected “based on their convenience and availability” (p. 158). The researcher used this method as a means to supply necessary demographic information

and provide preliminary identification of possible participants for the interview data collection phase.

Once the researcher identified potential participants for the target research sample, she used the purposeful sampling technique for the interview portion. Purposeful sampling is a nonprobability sampling method that allows the researcher to strategically select participants who are known to share experiences with the population under investigation (Creswell & Plano Clark, 2011). The inability to generalize the study's results is a weakness of the purposeful sampling method (Creswell, 2014). However, the researcher intentionally selected participants who could contribute to understanding the overall phenomenon (Creswell, 2014). Although bias is another weakness of the method, the researcher removed 17 participants from the study due to pre-existing relationships she had with them. By implementing this removal process, the researcher attempted to reduce the possibility of bias. Additionally, by incorporating the participants' voices, the potential bias of population underrepresentation was minimized (Simpson & Quigley, 2016).

The two sampling methods selected for this study were integrated to support the overall purpose of the study. Purposeful sampling to select the data producing sample ensured that interviews reflected the perspectives of a wide and varied population to best represent the target population as a whole (Simpson & Quigley, 2016). Together, the sampling methods provided the researcher with usable data that represented a range of grade levels, ages, and genders who experienced the same phenomenon of gamification in mathematics instructional programs.

Ethical Issues and Permissions

Prior to seeking IRB approval through the University of West Florida, the researcher completed the Collaborative Institutional Training Initiative Social and Behavioral Research

Basic Training Course and Conflicts of Interest Course. Both certificates of completion are presented in Appendix D. The support and approval were obtained through the hosting district through the process outlined in administrative regulations. These district regulations required that research only be conducted by existing employees of the district with supporting documentation submitted to support that the time and effort requirements needed by the study would not unduly interfere with the employee's regular duties. Written approval was obtained from the hosting campus and defined by the district as the campus employing the researcher. Copies of the approval are maintained at the hosting campus level as well as at the central administration offices with the deputy superintendent.

Upon receipt of approval from the hosting district and approval from the dissertation committee, the researcher proceeded with an application providing necessary documents and information to obtain approval for the study from the University of West Florida's IRB (Appendix E). The University of West Florida's IRB required that the parental consent form be revised to clarify the study participants as the student and not the parent. The IRB further stipulated that the students participating in the interviews were not permitted to have had any prior history with the researcher. This restriction was intended to reduce the potential for bias or coercion. To address this requirement, all students identified within the target research sample were verified by the researcher in cooperation with the study site to have not served as a student at the researcher's home campus during her years of district employment. Such eligibility was verified before interviews were scheduled. At the onset of each one-on-one interview, students were asked to confirm or deny whether they had ever been a student at the researcher's campus. The participant response provided to this question in addition to checking school records and with school staff served to verify eligibility for the study and compliance with the IRB's

stipulations for the study. Finally, the IRB reiterated full compliance with data security and storage according to University of West Florida Data Compliance and Restrictions by Service requirements.

Written parental consent (Appendix F) was obtained for the demographic survey, the interview, both, or neither through a letter explaining the purpose and intent of the study. Student assent for the electronic survey was explained in thorough, child-appropriate language verbally by the researcher and written through a paper-based assent document (Appendix F). Upon written student assent to participate, participants who proceeded to the survey accessed a screen where another opportunity for assent or dissent was presented electronically (Appendix F). Assent may be implied through participation in the survey although assent cannot be assumed in this setting as the respondent may not feel empowered to decline participation. As such, participants were given the opportunity to decline participation by selecting a certain response within the survey. This opportunity gave participants the appearance of completing the survey as directed and yet retaining the right to not participate. All survey responses were anonymous (Whelan, 2007) as no personally identifying information was requested. Furthermore, the survey was designed to not collect or report IP addresses which ensured that participants could not be identified. The survey was delivered to participants on school-owned computers. The survey was set up so that the participant was not required to log into any program, thus additionally protecting identifying information. As no personally identifying information was collected, data did not need to be coded for analysis or destroyed upon research completion.

Participants were informed prior to participation in the study that they had the right to withdraw from the study at any time, that their participation was strictly voluntary, and that findings would remain anonymous and confidential (Gill et al., 2008). Participants who were

identified as the target research sample were presented with two different modalities and opportunities to provide assent or dissent. Participants who volunteered and were selected to participate in the interviews were presented with a third and independent opportunity to provide assent or dissent. The researcher explained all directions and rights using age-appropriate language and other variances of dissent including changes in behavior, restlessness, uneasiness, body language, or body movements were monitored before the interview continued (Helseth & Slettebo, 2004).

Interviews present an ethical dilemma. Although the interview participant shares the information, the responsibility for authentic interpretation and dissemination of that information lies on the researcher (Gubrium & Holstein, 2002). In an effort to respect the participants' voices and combat the ethical issue of information control (Simpson & Quigley, 2016), participants' responses were transcribed verbatim (Gubrium & Holstein, 2002). Interview participants were selected on a volunteer basis through a paper form after completion of the electronic survey. Interview scripts used a combination of numbers and letters to code participant scripts and ensure confidentiality (Whelan, 2007). Such a renaming process followed the pattern of number representing grade level, then the letter "M" for male and "F" for female, followed by sequential alphabetical letters in order of the interview (e.g., 3MA for the first third-grade male student, 3MB for the second third-grade male student, 4FA for the first fourth-grade female student, and 4FB for the second fourth-grade female student). At no point in the process were scripts labeled with a student name or teacher name. A master coded list of student interview participants and coded identification was kept securely in a password-protected Google folder accessible only by the researcher and will be deleted upon completion, submission, and acceptance of the study.

In addition to meeting the ethical requirements of the hosting district and the University of West Florida IRB and seeking parental consent and student assent, the study retroactively explored students' attitudes towards gamified mathematics instructional programs. Mathematics instruction was not modified or manipulated for the purpose of this study, and this study did not interfere or influence the educational decisions made by the mathematics teachers for their students. To further prevent any interference in the instructional process, the researcher assumed the role of a detached observer (Mandell, 1988) by choosing to exclusively observe, annotate, and observe what already exists.

There were no foreseeable risks to the participants because the researcher offered participants multiple opportunities to provide or deny assent to participate in the study. Additionally, participation in the study did not affect instruction, grades, or educational plan. Conversely, participation in the study may result in benefits to the student, parents, and educational professionals. Students may gain a greater respect for and understanding of their levels of motivation, particularly within the context of participating in the district adopted gamified digital mathematics instructional program. The findings of this study may provide parents and caregivers with a greater understanding of their child's levels of self-reported motivation. Such information may support parents as advocates for their child's individualized learning experiences. These study findings may also benefit professionals in the education field by providing insight into the strategies and gamified components that more effectively motivate students.

Data Sources

The researcher used two data sources (i.e., survey, interview) to collect data. For this study, the researcher used an online, cross-sectional (i.e., data collected at one point in time;

Creswell, 2014) survey. A survey is a tool used to collect data from a number of participants in a timely manner by either paper or online format (Creswell, 2014). Surveys are beneficial when a specific audience is targeted or when the researcher wishes to use a predetermined set of questions to identify which portion of the population exudes a particular set of characteristics (Wright, 2005). Furthermore, since surveys offer structure with typically closed-ended questions, the responses can easily be summarized, scanned, or sorted by the researcher (Wright, 2005). Additionally, the anonymity of an online survey offers participants the freedom to respond without concern for repercussions or personal impact (Whelan, 2007). Although closed-ended questions limit responses and prevent responses that are outside the provided answer set, the researcher chose to utilize a survey to identify a qualifying target research population (Wright, 2005). Participants in the target research sample were further sorted and reduced through purposeful sampling to determine the data producing sample used for the interviews. During the interviews, the researcher ensured that all participants had an opportunity to clarify and extend their thinking through open-ended responses.

A phenomenological interviewing process provided feedback that was detailed to provide an opportunity for the researcher to deeply explore the phenomenon under investigation (Creswell & Poth, 2018). Phenomenological interviews provide a deeper understanding of a specific phenomenon under investigation by compiling the perspectives of multiple individuals into a collective understanding (Creswell & Poth, 2018). The depth of content and personal experience elicited by individual interviews provides an opportunity to explore a topic at length (Carter, Bryant-Lukosius, DiCenso, Blythe, & Neville, 2014).

Interviews present both advantages and disadvantages as a data source. One-on-one interviews, as opposed to focus groups, tend to afford participants the opportunity to provide

more personalized detail (Carter et al., 2014). During face-to-face interviews, the researcher can utilize nonverbal cues such as body language, tone, and intonation to guide further questioning (Opdenakker, 2006). These cues can pose an issue in that the participant can be influenced by the researcher's nonverbal cues or tones which might influence response or willingness to respond (Opdenakker, 2006). To address this potential issue, the researcher presented herself in clothing typical of the staff at the study site, the interviews were conducted within a tutoring room adjacent to the computer lab with a direct line of sight with the computer lab teacher, and the researcher remained acutely aware of her vocal tones and posturing throughout the interview. The interviews conducted during this study were audio recorded to improve accuracy (Opdenakker, 2006) and to record exact wording. Though transcribing audio recordings into written scripts is an effective method for improving the quality of the qualitative data obtained, the process is lengthy and laborious (Opdenakker, 2006). Nevertheless, the researcher believed that the benefits of the transcribed interview data outweighed the time required to conduct the work.

For this study, interview participants were intended to consist of three male and three female students in each third, fourth, and fifth grade which would have provided a combined 18 interview scripts. According to Polkinghorne (1989), phenomenological studies should consist of interviews from five to 25 different individuals who all have experience with the phenomenon under investigation. Instead, the researcher was able to schedule 20 interviews from a distribution of genders and grade levels different than anticipated. As age and gender are not variables in this study, this deviation was accepted by the researcher.

Participants were interviewed in a one-on-one setting in an environment that was familiar and comfortable to them. Before each interview, an assent document was reviewed with the

participant and signed by the participant and the researcher. Upon receipt of the participant's assent, the document was filed along with the copy of parental consent for the researcher's records. Interview questions were semi-scripted with the scripted questions (Appendix G). Unscripted questions resulted in direct response to participants' answers in an attempt to deepen and clarify understanding. Interviews were recorded electronically and then transposed to written transcript upon completion of the interview (Gill et al., 2008). The process of conducting individual interviews, transcribing the discussions from audio files, and then analyzing each script for patterns was a laborious process. Nevertheless, the depth of responses generated from the interview data made it a beneficial data source (Carter et al., 2014).

Description of Research Protocols/Instrumentation

Data from an electronic survey for demographic information collection and one-on-one semi-scripted interviews were examined in light of self-determination theory and the continuum of motivation (Deci & Ryan, 1985; Ryan & Deci, 2000) to shed light on the degree to which gamification impacted intrinsic and extrinsic motivation. The researcher created the survey with exclusively structured response items. Utilizing a variety of questioning formats, the survey was built to include four demographic questions. Two questions had dichotomous response options, and two questions had multiple choice options (Trochim, 2006). The first question required respondents to self-select gender. The second question required respondents to self-select age. The third question required respondents to self-select grade. The final question required respondents to self-select whether they participated in a computer math program at school at least once a week. The survey instrument that was designed for electronic delivery is presented in Appendix G. Table 1 shows the question type, response type, and question used in the survey instrument.

Table 1

Electronically Delivered Survey Administered to Elementary Students

Question type	Response type	Question
Assent	Dichotomous response	Agree to participate OR Do not want to participate
Demographic	Dichotomous response	Are you a . . . Boy OR Girl
Demographic	Multiple response	How old are you?
Demographic	Multiple response	Please select your grade
Demographic	Dichotomous response	Do you participate in a computer math program at school at least once a week?

During the phenomenological data collection, a semi-scripted interview consisting of 11 prompting questions was developed by the researcher. These questions were designed to explore key topics and to allow for divergence and supplemental questioning. Semi-scripted questioning is most appropriate when interviewing children in that the set questions offers structure while the flexible structure gives children the opportunity to explore the topic with the researcher (Gill et al., 2008). Semi-scripted interview questions were written in such a way as to stimulate discussion and reflection (Gill et al., 2008) regarding levels of self-reported student motivation thus exploring the constructs of self-determination theory (Deci & Ryan, 1985) within the context of gamification. Questions were written to be open-ended, neutrally worded, and easily understood by children (Gill et al., 2008; Legard, Keegan, & Ward, 2003).

The interview questions were developed in alignment with Bevan's (2014) descriptive phenomenological structure to explore the phenomenon of motivation thoroughly. The researcher began the process of writing the interview questions by researching Bevan's (2014) structure and studying question sets that utilized the structure. Once the researcher had formed an

understanding of the structure, she wrote draft questions. Questions were then revised according to alignment with the theoretical constructs of self-determination theory (i.e., autonomy, recognition/relatedness, self-efficacy/competence; Deci & Ryan, 1985, 2008). Questions were presented in a sequential order based on a progression through contextualization of the phenomenon, apprehending the phenomenon, and then clarifying the phenomenon. An alignment to this structure (Bevan, 2014) is presented in Table 2 along with the final interview questions. Within the interview protocol, three contextualization questions, six apprehension questions, and two clarifying questions were developed. Of these 11 questions, three questions set contexts and did not align to a theoretical construct, three questions were aligned to autonomy, one question was aligned to recognition/relatedness, and four questions were aligned to self-efficacy/competence.

Table 2

Phenomenological Interview Questions

Interview questions	Phenomenological structure	Construct alignment
This research study is focused on gamification in math computer programs. What do you think "gamification" means?	Contextualization	-
For this study, gamification is where an activity that is not a game has parts that act like a game to make the activity more interesting. Thinking about [insert name of gamified digital mathematics instructional program adopted by the site], what parts of the program do you think are a part of gamification?	Contextualization	-
Thinking about [using the elements the student identifies above], why do you think that is gamification?	Contextualization	-
How do you think [example(s) given by the student] motivates you to work in the program more?	Apprehending	Autonomy

Table 2

Phenomenological Interview Questions (continued)

Interview questions	Phenomenological structure	Construct alignment
How do you think [example(s) given by the student] motivate you to try to do more of the program?	Apprehending	Autonomy
How do you feel when you don't do well with the [gamified elements featured in the gamified digital mathematics instructional program adopted by the site i.e., reward levels/avatars/points/leaderboards]?	Apprehending	Self-efficacy/ competence
How do the [gamified elements featured in the gamified digital mathematics instructional program adopted by the site, i.e., reward levels/ avatars/ points/ leaderboards], make you feel?	Apprehending	Self-efficacy/ competence
How do you feel when you do well with the [gamified elements featured in the gamified digital mathematics instructional program adopted by the site i.e., reward levels/avatars/points/leaderboards]?	Apprehension	Self-efficacy/ competence
In what ways do you think [example(s) given by the participant] motivate you to learn more about math?	Clarifying	Self-efficacy/ competence
What would you change about [examples given by the student] to make you more interested in doing the program?	Clarifying	Autonomy

The interview was designed to be completed in a single setting lasting no more than 15 minutes. Interviews with all 20 participants were completed in one afternoon. These interview questions, designed to stimulate a quality, focused discussion are presented in Appendix G.

Data Collection Procedures

Recruitment of participants complied with all district and the University of West Florida IRB procedures for a research study with human subjects. Before data collection began, permission from the deputy superintendent of the hosting district and the site principal was obtained in accordance with local board policy and administrative regulations (Appendix C). An email was sent to all third-, fourth-, and fifth-grade teachers and site administrators to introduce

the study. The email outlined the purpose of the study, procedures for gaining parental consent and student assent, schedule of surveys, approximate days of scheduled interviews, and gave an opportunity for staff to ask questions. A few questions were received by the researcher, mostly needing timeline clarification or further detail regarding the purpose of the study. These questions were answered through email to the satisfaction of the school staff member asking the question. Parent information letters were then sent home explaining the study, ensuring participant anonymity (Whelan, 2007) and requesting signed permission for their child to participate in the study. A copy of all recruitment materials including emails to staff and letters to parents is presented in Appendix B.

Data collection occurred during the Spring 2018 semester to provide for adequate exposure and participation within a gamified mathematics program during the school year. The study target population consisted of five third-grade classrooms, six fourth-grade classrooms, and five fifth-grade classrooms. Class sets of study introduction and invitations were prepared and placed in the box of every third-, fourth-, and fifth-grade teacher on Friday, April 27, 2018. Approximately 300 students were invited to participate through letters sent to the parents. Each invitation was sent home by way of the homeroom teacher and included an introductory letter, consent documents, and copies for parents to retain. Study invitations were sent on Monday, April 30, 2018, and due back by Friday, May 4, 2018. The office staff at the school were prompted with how to direct parent questions and where to collect signed documents that might be turned into the office. All signed and returned consent documents were retrieved by the researcher from the site's front office on Friday, May 4, 2018. The researcher then checked in with the site daily as data collection continued so as to not miss or overlook any eligible participant. The researcher created a spreadsheet of all returned consent forms indicating student

name, specific consent offered (none, survey only, survey and interview, and/or audio recording), and indication from the parent to receive a copy of the completed study. This signed consent database was color-coded to properly manage student participation.

Surveys were administered during a class' regularly scheduled computer lab time according to the site's master schedule. The researcher attended every third-, fourth-, and fifth-grade computer lab class for four consecutive days from May 7, 2018, through May 10, 2018, which permitted accessibility to all third-, fourth-, and fifth-grade students at the study site. Prior to beginning a survey session, the researcher checked in with the site's front office and collected any additional consent forms that had been returned.

Before a survey session, the researcher asked each class if anyone had consent forms that were signed but had not been returned. With the permission of the site's office staff, those students who needed to turn in their consent documents were permitted to retrieve the forms from their backpack or classroom prior to the survey session beginning. Potential participants were identified and relocated to one side of the computer lab. Sessions began with an explanation of the study, opportunity for the potential participants to ask questions, and offering of assent documents. Several participants did ask clarifying questions such as "I don't understand, what do you want to learn when we do this?" to which the researcher replied, "I want to learn about how math programs on the computer make you feel." These questions were answered by either repeating or paraphrasing components of the scripted introduction until potential participants felt comfortable with the study enough to make a decision whether to assent or decline participation in the study.

At the scheduled study start date, potential participants with signed parental consent documents cycled through the computer lab during their regularly scheduled rotation and were

offered a hard copy of the assent documents during a scripted introduction. Respondents who agreed to participate in the study proceeded to the survey where a second opportunity for assent was offered. Those respondents who continued through to the survey, had parental consent, and provided assent were offered the opportunity to participate in the interview portion of the study.

A Google Form was utilized to anonymously collect survey responses by removing the ability to collect email addresses, identifying information, and did not require participants to log in. The accessing link was shortened to a "Tiny URL" web address using the website http://www.tinyurl.com to minimize accessibility issues for participants. This web address was printed on individual cards for each participant and distributed after obtaining written assent. Assenting participants were directed to proceed to the survey. The survey began with a scripted introduction given both verbally and written as an introduction page of the survey explaining the purpose of the study. The researcher used age-appropriate language to ensure that this introduction was presented clearly and did not cause participants to feel uncomfortable (Helseth & Slettebo, 2004). The scripted overview of the study helped participants focus on the topic of gamification components experienced within the digital mathematics instructional program. The subsequent screen of the survey included another opportunity for participants to give assent for their participation or exit the survey without issue. These layers of consent and assent ensured that participants understood that they could withdraw from the study at any time, participate voluntarily, and that their responses were anonymous (Gill et al., 2008). The survey consisted of basic and non-identifying demographic-based questions. The researcher clarified instructions or helped participants with the electronic survey on an individual basis as requested by participants. Participants did not appear reluctant to requesting assistance on wording or directions from the

researcher. Completion of the survey during the existing computer lab rotation limited the impact or interference with classroom instruction.

Upon completion of the demographic survey, participants were given the opportunity to volunteer as interview participants. Participants indicated their willingness to participate in the interview portion of the study through a separate and unrelated paper form (Appendix F) that the researcher offered to each participant. The form was separate from the electronic survey to maintain the anonymity of the survey results. The list of interview candidates was verified by the researcher in coordination with the study site to verify that participants had not been served by the researcher's home campus during the years that the researcher has been employed by the district. This verification process produced a list of eligible interview participants. Interviews were then scheduled two weeks immediately following the survey administration. Parents had provided consent for either the survey in isolation or both the survey and the interviews, thus permitting participants to volunteers with combined survey and interview consent to proceed with the study without requiring further recruitment or parental consent.

Qualitative interviews were conducted on May 21, 2018. At the onset of each interview, the participants were queried for their desire to continue participation in the study and had the opportunity to provide or decline assent for participation in the interview. Interviews took place in a tutoring classroom adjacent to the computer lab that was made available by the site. Participants were familiarized with the purpose of the study and the structure of the interview. Member checking was used throughout the interview process to ensure that the researcher adequately understood and represented the perspective of each participant (Simpson & Quigley, 2016). The study did not interfere with instructional time. All surveys were completed within the same one-week period with interviews scheduled approximately two weeks after the surveys.

Participation in the survey took no more than 20 minutes to complete, and participation in the interview took no more than 10 minutes to complete. The data collection design was simple in administration and did not require extensive classroom time or necessitate teacher effort. Only scheduling cooperation was needed, and the site selected was accommodating to the timing and location needs of the researcher.

Researcher Positionality

The researcher serves as an elementary-level school administrator in the same district as the site. She is an instructional leader on her campus with a particular interest and skill set in technology integration. Despite these characteristics, the researcher had no direct relationship to the participants of this study but served the district as an administrator on a separate campus. The researcher's position within the district allowed her to use a prior social and professional relationship to facilitate the process of obtaining site permission and developing a data collection schedule. This study did not give preference or incentive to students with a prior relationship with the researcher because all third-, fourth-, and fifth-grade students at the site were invited to participate and not limited to those students who the researcher might have selected. Any possible prior relationship or knowledge of the researcher might have skewed data by either putting students at ease allowing them to feel more comfortable in offering assent or present an environment of coercion or obligation. To mitigate this issue, the University of West Florida's IRB stipulated that participants did not have any prior relationship to the researcher. This stipulation is presented within the conditional approval letter presented in Appendix E. Upon meeting all three requirements of the IRB, a full approval letter was granted and is also presented in Appendix E.

The researcher selected the topic and problem under investigation based on her professional experiences and observations in her position as a school administrator. She realized that students were willing and motivated to play video games on their personal devices during non-instructional times of the day, but some students were reluctant to work on instructional programs in the computer lab. Further observation of this phenomenon revealed that some students appeared to be extremely motivated to practice their mathematics in the computer lab while other students would appear to be unmotivated. These seemingly unmotivated students would demonstrate apathetic, off-task, or distracting behaviors usually resulting in the teacher redirecting or penalizing the inappropriate behavior. Based on these observations, the researcher decided to explore the phenomenon of motivation with regards to gamified mathematics instructional programs. The researcher hoped that such exploration might support her students and teachers to motivate reluctant learners.

Ensuring Trustworthiness and Rigor

The researcher used several techniques to preserve the trustworthiness and rigor of the study. The study population included convenience sampling (Creswell, 2014) across entire grade levels without discrimination for specific teachers or sections to identify a target research sample. From this target research sample, a data producing sample was identified to support and adequately explore the phenomenon under investigation. Although these sampling methods did not require or incentivize participation in the study, the methods reduced the potential for specific students to be selected as participants based on a prior relationship with the researcher and reduced the opportunity for researcher bias to interfere with the study sample.

Credibility. Shenton (2004) recommended that a researcher use recognized and established research methods. As such, several methods including an interview structure,

disclosure of the researcher's positionality, triangulation of participants' perspectives, multiple opportunities for participants to refuse participation, and member checking were utilized by this study (Shenton, 2004). Semi-scripted interview questions within the interviews allowed sufficient structure to guide the interview and also allowed participants and the researcher the opportunity to deviate (Gill et al., 2008). Questions must be preplanned so as not to lead or predispose participants to answer in a way they might feel would make the researcher happy (Gill et al., 2008). As such, the questions and the researcher will remain neutral, asking scripted or clarifying questions but not providing positive or negative feedback to responses. Interview scripts were electronically recorded and then transposed exactly as dictated preserving student voice and word choice (Creswell, 2014; Gill et al., 2008; Mills et al., 2006). Throughout each interview, a process of member checking was utilized, and feedback was solicited from each participant to ensure that every idea was clearly communicated and properly interpreted (Merriam, 2009).

One form of member checking involves sharing the transposed transcripts with each student (Birt, Scott, Cavers, Campbell, & Walter, 2016). The researcher was concerned that this technique might cause participants to modify or delete their contributions in an effort to please the researcher (Birt et al., 2016). Instead, as appropriate after each question and answer set, the researcher summarized each response and solicited the approval or clarification from the participant (Simpson & Quigley, 2016). Such a process of member checking embedded within the interview is more appropriately used with adolescent participants than other types of member checking (e.g., a review of the transcripts, a subsequent interview to review data analysis, sharing of findings; Simpson & Quigley, 2016). Data from the perspectives of all 20 interview participants were triangulated together to produce a justification for the themes that emerged

(Creswell, 2014). Data were color-coded based on the themes that emerged (Creswell, 2014). These methods further built credibility for the developed patterns between gamification and motivation. Furthermore, this study included discussions regarding the researcher's positionality and potential bias. Such a discussion promoted transparency in the findings and improved the credibility of the study (Creswell, 2014).

Transferability. The degree of reliability a study can tout is directly related to the repeatability and transferability of the research (Delice, 2010). Repeatability is arguably one of the most important quality control factors of a research study (McNeil & Chapman, 2005) and is dependent upon a sample that can be replicated (Henn, Weinstein, & Foard, 2006). Specific sample and population information, as well as step-by-step data collection procedures (Shenton, 2004), were discussed in detail throughout this study, thus improving the likelihood that a similar population would yield similar findings. Transferability of a study is also directly related to the thickness and level of detail provided in the discussion (Creswell, 2014). By providing rich descriptions, this study can be compared across other related studies (Merriam, 1998). Within this study, the researcher along with her committee and multiple levels of review by the University of West Florida attempted to include thick detail regarding every aspect of this study's design. This review process also critically evaluated the alignment among the problem statement, purpose statement, research questions, theoretical framework, and research design to support transferability of the study findings.

Dependability. To preserve the dependability of this study, a thorough discussion of the research design and procedures as well as the rationale for both were included. The constructivist approach required that the participants' voices remain intact throughout the data analysis process (Mills et al., 2006). A process of member checking was used to protect the participants' voices

during the interview process (Merriam, 2009; Simpson & Quigley, 2016). Furthermore, the participants' voices and perspectives were intertwined with the researcher's view, which then developed a theme from the interpretation of such voices (Mills et al., 2006). Such an interpretation is presented through a narrative approach (Creswell, 2014). Using a combination of the constructivist approach and the narrative approach, the researcher used narrative data to construct meaning concerning the connection between gamification and motivation. Follow-up questions were used to clarify the researcher's understanding of the participants' responses and deepen the overall meaning of the data. The context of the study provided for an instructional setting where instruction and program participation were not altered during the course of the study thereby protecting the study's findings from being skewed by a change in variables beyond the scope of this study. Balancing the narrative of the interviews with the researcher's interpretation helped to improve the credibility of the study's findings.

Confirmability. Confirmability of a study directly relates to the study's major findings as they confirm or contradict the findings of other studies (Creswell, 2014). Such a process of comparing across the body of literature requires reflective commentary regarding the strengths and weaknesses of each comparative study (Shenton, 2004). Through the discussions contained in Chapter 5, the findings from this study are compared and contrasted with the conclusions presented by other studies for similarities and differences. Another component of confirmability is the consistency of the findings across all participants to minimize the impact of the researcher's interpretations (Shenton, 2004). Within this study, triangulation across 20 different participants' perspectives helped to develop confirmable themes that minimized the interpretations of the researcher (Shenton, 2004).

Data Analysis Techniques

Consistent with an interpretative phenomenological qualitative approach, interviews were audio recorded, transcribed, and coded for patterns to address the research questions. Demographic information was obtained through a survey to identify a target research sample. Responses to the survey were used to purposefully select a data producing sample. Interview participants were coded based on grade, gender, and sequence. Student names were not used or identified during the analysis of this study. The researcher provided each participant with a participant identifier. Audio files were recorded using the researcher's laptop and then saved to a password-protected folder in Google Drive. After recording each interview, the researcher transcribed each audio recording into a typed transcript and coded the transcript with the participant identifier. Transcribed interviews were securely stored in Google Drive and labeled according to the participant identifier assigned. After completion, submission, and acceptance of this study, audio recordings will be permanently deleted while transcripts will be retained for a period not less than two years. The researcher will retain protected access to the audio files and transcripts during the time period that they are stored.

To analyze the interview scripts, the scripted questions were transferred to a spreadsheet, and the participant responses to each question were copied into each cell along the row. Questions posed during the interview but not previously scripted were also copied into a row, but responses were recorded individually for those participants who answered those questions. The researcher then printed all spreadsheets with scripted and unscripted questions and all responses. The researcher read through all scripts without interruption or analysis to gain an overall understanding of the participants' points of view. Then, the researcher progressed through the scripts one question at a time and circled specific motivators indicated. Using a pink (for

hypothetical motivators), blue (for intrinsic motivators), or orange (for extrinsic motivators) highlighter, the researcher highlighted phrases or quotes within the typed transcripts of each interview to indicate significant statements that contributed to the researcher's understanding about the phenomenon (Creswell & Poth, 2018). Such statements were tallied by color (type) in a spreadsheet to identify repeating topics (Creswell, 2014).

Topics identified included gamification components recognized by the student, favorite gamified components, most helpful and least helpful gamified components, examples of goal-setting, response to feedback, and overall feelings of learning success. Such "clusters of meaning" (Creswell & Poth, 2018, p. 61) allowed the researcher to aggregate overall themes. Key terms, phrases, or concepts were listed according to topic according to the frequency of the topic resulting in a compiled list of coded concepts. Specific motivators (e.g., enjoyment, competition, learning) were circled when they appeared in the scripts. The researcher then categorized each motivator by type as intrinsic or extrinsic and then further categorized each motivator by subtype. The frequency of these themes was triangulated across all scripts (Merriam, 2009) to identify trends and patterns.

Triangulation was an appropriate process to merge multiple viewpoints (Creswell & Plano Clark, 2007). Triangulation methods can be sorted into four different types: method triangulation, investigator triangulation, theory triangulation, and data source triangulation (Carter et al., 2014). As this study followed a qualitative design, data source triangulation was used. Such a process utilized complementary methods to collect data about a consistent topic (Carter et al., 2014). Key words from the interview scripts were organized into type and subtype to align with the theoretical framework. Organizing the information in this way allowed the researcher to make direct comparisons across all interview scripts and draw conclusions about

patterns and themes. Such patterns were compared to what would be expected within the constructs of self-determination theory (Ryan & Deci, 2000). Self-determination theory asserted that increased student motivation could be connected with feelings of self-efficacy, interest, and autonomy (Ryan & Deci, 2000). In this study, the researcher looked for similar patterns within the context of gamification in a computer-based mathematics instructional program.

Chapter Summary

Whereas qualitative research strives to look for the big picture idea to test the merits of an existing theory, quantitative research focuses on the details to develop new theories (Yilmaz, 2013). As a generalization, quantitative research is explanatory while qualitative research is exploratory (Trochim, 2006). Qualitative methods with an exploratory approach were considered most appropriate for this study. When considering gamification as a contemporary application of self-determination theory (Ryan & Deci, 2000), a qualitative design to consider multiple participant perspectives (Johnson et al., 2007) was most appropriately done through a series of qualitative interviews. Due to the complicated nature of gamification components and their intended impact upon student motivation, the researcher selected an interpretative phenomenological design as an appropriate method to evaluate the phenomenon (Johnson et al., 2007) and to address the study's purpose statement. One-on-one interviews gave the researcher an opportunity to gain greater depth and understanding about the impact that gamified components embedded within elementary-level mathematics instructional programs might have on participants' self-reported levels of motivation.

With a focus on elementary-aged students, the study recruited participants in third, fourth, and fifth grade who participated in a gamified mathematics instructional program at least once a week at the site. The researcher used many methods and techniques to obtain permission

to conduct the study, gain site access, and recruit study participants. Ethical, trustworthiness, and rigor issues were considered and discussed in this chapter. This chapter also included discussions on the process whereby all data were collected and analyzed. Then, the chapter contained a discussion on how each interview transcript was individually coded. Interview data were compiled by question, read for overall concepts, highlighted by concept, and coded by motivator according to the types and subtypes of motivation explored by this study. Triangulation was used to merge the scripts and identify patterns and themes (Creswell & Plano Clark, 2007). In the context of the theoretical framework and research questions, the analyzed and triangulated datasets were then used to formulate a response to each of the research questions.

Chapter 4: Data Analysis and Findings

The purpose of this qualitative study was to identify how intrinsic and extrinsic motivators embedded within gamified digital mathematics instructional programs contribute to motivation levels of third- through fifth-grade students at an elementary school located in central Texas. The following overarching research question guided this study: To what extent and in what ways do gamified components embedded in an elementary-level digital mathematics instructional program contribute to students' motivation levels? The study used an electronic survey to gather demographic data for a target research sample. From this target research sample, a data producing sample was identified. Using Bevan's (2014) descriptive phenomenological approach to interviewing, the researcher created 11 semi-scripted interview questions. These questions were asked during one-on-one interviews with 20 participants. The interview scripts served to address the following research sub-questions:

RQ1. Which extrinsic motivators embedded within an elementary-level digital mathematics instructional program contribute to student motivation?

RQ2. Which intrinsic motivators embedded within an elementary-level digital mathematics instructional program contribute to student motivation?

The chapter begins with a general overview of the study and includes a discussion regarding the study participants. Specifically, this chapter includes an itemized discussion of the data producing sample followed by a discussion of the data preparation and subsequent data analysis. The presentation of data preparation procedures and the study's findings within this chapter are organized initially by research questions and secondly by themes within each research question. According to each research question, this chapter includes discussions on the presentation of the data followed by an analysis of the data. Data were analyzed according to

each research question to identify “clusters of meaning” (Creswell & Poth, 2018, p. 61) into themes. The frequency of these themes (Merriam, 2009) allowed the researcher to develop and present findings relative to the phenomenon under investigation. After the discussions relative to the credibility of the data and the inconsistent or unexpected findings, the discussions reveal connections that the researcher made with relevant studies and literature. Finally, the chapter concludes with a summary of the major issues raised in the chapter and foreshadows the intent of the final chapter.

Description of Participants

All participants were students enrolled in third-, fourth-, or fifth-grade; self-reported to be eight years of age or older; and participated in a gamified digital mathematics instructional program at least once per week. A breakdown of the characteristics of the target research sample and data producing sample is presented in Table 3. Of the 38 participants comprising the target research sample, 17 (45%) were female and 21 (55%) were male. All grade levels included in this study were represented by the target research sample including 16 third-grade students, 16 fourth-grade students, and six fifth-grade students. A range of ages were represented; three participants were eight years of age, 18 participants were nine years of age, 10 participants were 10 years of age, and seven participants were 11 years of age. Of the 20 purposefully selected interview participants comprising the data producing sample, 11 (55%) of the participants were female, and nine (45%) of the participants were male. Interview participants represented all three grade levels including nine third-grade students, eight fourth-grade students, and three fifth-grade students. Age was not collected from the interview participants because age was self-reported by the participant during the identification of the target research sample.

Table 3

Characteristics of Study Participants

	Target research sample	Data producing sample
Gender		
Male	21	9
Female	17	11
Grade level		
3rd grade	16	9
4th grade	16	8
5th grade	6	3
Age		
8 years old	3	-
9 years old	18	-
10 years old	10	-
11 years old	7	-

Note. $N = 38$ for target research sample; $N = 20$ for data producing sample.

Data Preparation

This interpretative phenomenological qualitative methods study used an electronic survey to collect demographic and eligibility information to produce a target research sample. The survey was administered to a total of 40 participants with signed parental consent and who offered student assent. Of these 40 survey responses, two responses were removed because the participant responded with “no” when asked if they participated in a computer-based mathematics program at least once per week. The 38 remaining responses met all qualifications for inclusion in the target research sample. A data producing sample was identified through purposeful sampling. Using purposeful sampling techniques, the researcher removed any participants who had a prior relationship with the researcher.

Interviews were recorded using the researcher’s laptop, and recordings were saved with a file name according to the assigned participant identifier. Recordings were then saved to a secure Google Drive folder. After all 20 interviews were completed, the researcher transcribed the

interviews and saved them as individual Google document files according to the assigned participant. Once all interviews were transcribed, a spreadsheet was developed to indicate each of the primary interview questions (Appendix G) and each participant's response as well as to indicate the responses for any unscripted questions. Using a spreadsheet allowed the researcher to directly compare responses across participants for the same question. Exploring responses to the unscripted questions allowed for deeper understanding of the topic according to the viewpoint of the participant. Participants' responses were recorded, transcribed, and compiled according to each participant's style of speaking. The researcher did not clean or remove filler words including "like," "um," and "yeah." This procedure allowed for the participants' voices to remain intact throughout the data analysis process (Mills et al., 2006). The spreadsheets for each interview were then compared across responses in multiple ways.

For the first three contextualization (Bevan, 2014) scripted questions (Appendix G), responses were coded with a "+" for an accurate answer, "~" for an informed attempt, and "-" for no response or a completely unrelated response. Scores were marked directly on the scripts and tallied in an Excel© spreadsheet. These responses and the subsequent coding process helped the researcher to form a baseline for understanding the participants' knowledge of the topic and guided the researcher's interpretation of the responses to the unscripted questions.

The six apprehending (Bevan, 2014) scripted questions (Appendix G) directly addressed RQ1 and RQ2. Participants' responses were evaluated to identify specific gamification components, which were then categorized as either intrinsic or extrinsic motivators. The researcher then identified the participants' emotional responses to that type of motivator. To facilitate this coding, every response was scanned for specific motivators identified by the participant. These motivators were circled to identify them in context. After all motivators were

identified, each motivator type was listed, and tally marks were used to identify how many participants identified that same or similar motivator. These motivators were then categorized first by type (extrinsic or intrinsic) and then by subtype (interest/enjoyment, perceived competence, effort/importance, perceived choice, value/usefulness, external regulation, introjected regulation, or identified regulation). Using the color blue for intrinsic motivators and the color orange for extrinsic motivators, the previously circled motivators were color-coded according to type. Then the corresponding emotional response to that motivator, as indicated by the participant, was color-coded to match. This color-coding system allowed for thematic connections, consistent responses, or reoccurring ideas to be highlighted (Creswell, 2014).

The final two clarifying (Bevan, 2014) scripted questions (Appendix G) gave the participants an opportunity to expand the impact of their statements and allowed the researcher an opportunity to explore motivators that the participants considered most motivating, even if those components did not yet exist within the programs. Within each response to these questions, the specific motivator or modifier identified by the participant was color-coded in pink. These pink words or phrases were then listed, and tally marks were used to determine the frequency of similar responses.

After the researcher compiled frequency data for motivators that participants specifically identified, the researcher then highlighted additional motivators or modifications that participants recommended. The researcher also combed the scripts for quotes to incorporate into the analysis component of the study. As the presentation of findings and analysis was developed, the researcher placed a check mark in the spreadsheet cell of each response as that quote was integrated into the presentation of findings. This system ensured that a variety of responses across all participants were quoted and prevented the researcher from inadvertently ignoring

some scripts while placing too much priority on other scripts. If the researcher noticed that quotes were not being used from a particular script, then the researcher refocused her attention on incorporating the unused data so that the final analysis utilized direct quotes from male and female participants across the three grade levels. This process of incorporating data across all scripts ensured that the data producing sample represented the overall population with as much accuracy as possible.

Presentation and Analysis of Findings

After transcribing and coding the interview scripts, the researcher then combined data across all interview scripts and analyzed them to address the overarching research question. From this overarching research question, two primary concepts remained to be addressed. First, the researcher drew conclusions regarding the impact gamified components have upon participants' self-reported levels of motivation. Secondly, the researcher commented on those components, separated into extrinsic and intrinsic motivators that the participants most reported to motivate their participation in the gamified learning programs.

Semi-scripted interviews provided various types of data that were used to build understanding regarding the phenomenon of gamification within digital mathematics instructional programs. The researcher was able to convert some of the interview data to frequency tables. Other data were kept in scripted quotes to preserve participants' voice and show variations across different participants. Interview responses were analyzed individually by question across all responses. The first three questions, comprising the contextualization portion of Bevan's (2014) descriptive phenomenological interview process, were scored according to the accuracy of the answer. The six apprehending (Bevan, 2014) scripted questions (Appendix G) as well as any unscripted questions that were generated during the interview were scanned for

specific gamified elements, categorized as either extrinsic or intrinsic motivators, and then the participants' emotional response to that motivator was identified. The final two clarifying (Bevan, 2014) scripted questions were then reviewed for themes to deepen the researcher's understanding of participant identified motivators, even if those motivators were not yet present in the gamified programs.

Contextualizing the phenomenon. The specific scoring protocol used for each of the first three contextualization questions utilized a "+," "~," or "-" according to the accuracy of the response. When asked to explain gamification, two participants succinctly connected the purpose of gamification in the following responses: "Like, using math programs to help kids learn" (4MA, personal communication, May 21, 2018) and "Um, a type of game like playing a game that will help your skills get better" (4MC, personal communication, May 21, 2018). These two responses were given a "+" because they included the concept of a game or program that was intended to stimulate learning. Since 10% of the participants interviewed had background knowledge regarding the context of this study, the researcher determined that the term "gamification" was likely not a part of the academic vocabulary of the participants even though it was an instructional strategy being used (Johnson et al., 2013; Lee & Hammer, 2011; Reeve & Lee, 2014). Other responses to this initial contextualization question that scored a "~" contained either the learning component or the gaming component but did not combine the two ideas. Examples of these answers included "Um, it has games involved with it," (4FE, personal communication, May 21, 2018) "Um, I think like different games," (4MB, personal communication, May 21, 2018) and "Like math games" (3MB, personal communication, May 21, 2018). These responses indicated to the researcher that the participants could be prompted to identify the context of this study. This connection to the context of this study indicated that

participants could recognize some level of academic purpose even if they could not provide a fully accurate response.

In total, 55% of the participants indicated a minimal level of understanding of the topic. Responses that received a "-" included nonresponses such as "I have no clue," (5MA, personal communication, May 21, 2018) "I don't know," (4FD, personal communication, May 21, 2018) and "Um . . ." (5FA, personal communication, May 21, 2018). These nonresponses comprised 35% of the scripts which indicated to the researcher that there was a significant portion of the interview sample who had no context from which to formulate answers. This lack of context is one of the primary reasons that the researcher selected a semi-scripted approach (Gill et al., 2008). For participants who provided a nonresponse, the researcher provided additional context, simplified terminology, used synonyms, and asked unscripted questions in an effort to preserve the integrity of the interview.

The second scripted contextualization question required that the participant provide a specific example of gamification. Using the knowledge gained from the first question, the researcher asked follow-up questions or answered the participant's questions to ensure question comprehension. A score of "+" was given when a participant provided a specific example such as "Like where you get a, like you answer questions and you get points or something like you get points and later you use them to buy stuff for your avatar" (5MA, personal communication, May 21, 2018). In this sample response, "points," "buy stuff," and "avatar" were identified as specific motivators yielding a "+" score. The vast majority of the participants (85%) accurately identified and provided an example of gamification. To the researcher, this percentage indicated that although most participants were unfamiliar with the term, they were aware of components embedded within the mathematics instructional program.

A score of "~" was given for a response where specific motivators may have been inadvertently supplied but the participant was not confident in his or her response. An example of this type of response was given by Participant 4FB (personal communication, May 21, 2018) when the following answer was provided: "Um, like Think Through Math, after the, the post-quiz and then you do a game and then you do . . . " The participant mentioned a "game" but did not make any meaningful connection to the response. Ten percent of the participants responded in this manner which indicated to the researcher that additional unscripted support, clarification, or restating may help promote understanding of the study topic. A score of "-" was given for the single incomplete answer, such as "um, some parts" (4FD, personal communication, May 21, 2018). This participant was able to discuss the games and profiles in the digital program and described those elements as "fun and interesting" (4FD, personal communication, May 21, 2018) once prompted with additional questions.

The third scripted contextualization question looked for a connection between the definition supplied by the participant in Question 1 (or the information derived from Question 2) and the gamified components identified by the participant in Question 2. A "+" scoring answer was marked for participants who made this connection. For example, Participant 5FA stated, "Because it's not just games. It has parts in the program that, um, it's not just games. It has other like parts where you're working and then parts that you're learning while having fun doing the games" (personal communication, May 21, 2018). This answer directly aligned to the definition of gamification (i.e., a gamified activity for a purpose beyond the game itself; Werhach & Hunter, 2012).

After scoring each response, 45% of the participants articulated this type of a response. The progression from minimal understanding to predominant understanding reassured the

researcher that the interviews could provide meaningful data about the problem under investigation. This progression also reinforced the effectiveness of the interview structure which was selected because it used initial questioning to provide context and to establish comprehension of the phenomenon (Bevan, 2014). A "~" scoring response achieved part of the connection between gamification and learning but missed either the academic or the gamified component. An example of a participant response that missed the academic component was "because they just seem fun a lot and whenever they're like funner to play. They have like fun details and stuff added to it that seems fun" (3FC, personal communication, May 21, 2018). Although fun, enjoyment, and interest were all intrinsic motivators connected to the study's purpose and research questions, partial responses did not completely align with the definition of gamification as presented in this study. These responses identified specific types of motivation that could be later tallied for frequency. In contrast, Participants 5MA and 5MB focused only on the academic component and did not acknowledge the gamified component in the following responses: "because that's not really math," (5MA, personal communication, May 21, 2018) and "because it's not the math in it" (5MB, personal communication, May 21, 2018). These responses required additional evaluation with further questioning. Participants may have given a strictly academic response for the love of learning (intrinsic motivation) or to obtain a satisfactory grade (extrinsic motivation). The apprehension section of questioning was then used to explore the concept of gamification with the participants to further understand the specific type and subtype of motivation they would report. A score of "-" was given for a silent or non-response such as "I really don't have the answer" (4FC, personal communication, May 21, 2018). Approximately 20% of the participants were unable to provide a specific example of

gamification which indicated to the researcher that further questioning might be difficult for the participants to contextualize.

During the contextualization phase of the interview, the responses demonstrated a progression from lacking context to gaining context as the questions continued. This progression of understanding was demonstrated in Table 4 by the contrast in "+" (two) responses in the first question as compared to the much higher number of "+" responses in the subsequent two questions (17 and nine respectively). Some participants quickly identified the definition of gamification as "Um, the math part where like in Think Through Math where the answer like they ask you questions but you think it's a game" (Participant 4FC, personal communication, May 21, 2018). Participant 5MA (personal communication, May 21, 2018) immediately related gamification to the extrinsic rewards the programs could offer in the following answer: "Like where you get a, like you answer questions and you get points or something like you get points and later you use them to buy stuff for your avatar." Participant 3MC (personal communication, May 21, 2018) used a word association to help him generate the following definition:

> Gamification. Well it's a bit, it's kind of like identification because it kind of sounds the same as identification means finding out something about it. So, games would probably mean something about games. Because it's gamification. It would probably mean like what you do in the games.

Once given a definition and some context about gamification, 17 out of 20 participants were able to assimilate that information with their prior knowledge and personal experiences to produce some examples of gamification. This process of building context and then providing meaningful, topic-specific information was a critical part of the process. The process demonstrated to the researcher that participants were aware that certain elements within the

digital mathematics programs were motivating even if the participants did not have the technical vocabulary to express it. From the data generated by this study, 10% of the participants interviewed presented with a thorough background knowledge of gamification. After context was given by the researcher, 85% of the interviewed participants supplied an accurate example of gamification within the context of their personal interactions with gamified learning programs. Concerning the application of the definition of gamification with personally identified gamified components, 45% of participants were able to accurately make a connection. The contrast in findings among Question 1, Question 2, and Question 3 indicated that participants may have had a more practical knowledge of gamification and lacked the technical terminology to fully understand the researcher's initial question.

Table 4

Semi-scripted Contextualization Interview Responses

Contextualization Question	+	~	-
This research study is focused on gamification in math computer programs. What do you think "gamification" means?	2	11	7
For this study, gamification is where an activity that is not a game has parts that act like a game to make the activity more interesting. Thinking about [insert name of gamified digital mathematics instructional program adopted by the campus], what parts of the program do you think are a part of gamification?	17	2	1
Thinking about [using the elements the participant identifies above], why do you think that is gamification?	9	7	4

Note. Values are presented according to a scoring protocol of "+" for an accurate answer, "~" for an informed attempt, and "-" for no response or a completely unrelated response.

Apprehending the phenomenon. After the first three contextualization questions, the researcher asked six questions to determine participants' apprehension of the phenomenon. These questions were augmented and interspersed with unscripted questions to accommodate

participants who had previously responded with incomplete answers or otherwise demonstrated a lack of understanding. The researcher used several techniques including paraphrasing, rephrasing, synonyms, repeating the question, and repeating the participant's previous answers to support understanding. The responses from the six apprehension (Bevan, 2014) questions were visually scanned across all scripts for specific examples of gamification. Such examples are identified and presented along with the frequency of each response across all interviews in Table 5. To best address the two research sub-questions presented by this study, the participant-supplied motivators were categorized according to the subtypes of intrinsic motivation (interest/enjoyment, perceived competence, effort/importance, perceived choice, and value/usefulness) and subtypes of extrinsic motivation (external regulation, introjected regulation, and identified regulation).

Table 5

Participant-supplied Motivators from Interviews by Type and Subtype

Participant -Supplied Motivator	Motivation Type	Motivation Subtype	Frequency
Games	Intrinsic	Interest/enjoyment	16
Fun	Intrinsic	Interest/enjoyment	12
Avatars/characters/profile	Extrinsic	Identified regulation	11
Points/coins/scores/tokens	Extrinsic	External regulation	11
Learning	Intrinsic	Value/usefulness	10
Bonus rounds/levels/worlds	Intrinsic	Perceived competence	5
Buy stuff	Extrinsic	External regulation	5
Stars/lights/ring bell	Extrinsic	Identified regulation	4
Battle monsters	Intrinsic	Interest/enjoyment	3
Brag to friends	Extrinsic	Introjected regulation	3
Carnival/fair	Intrinsic	Interest/enjoyment	2
Choices	Intrinsic	Perceived choice	2
Lose a life/power damage	Extrinsic	Identified regulation	2
Classroom poster	Extrinsic	Introjected regulation	1
Compete with friends	Extrinsic	Introjected regulation	1
Help friends	Intrinsic	Value/usefulness	1

Research Question 1. To best address RQ1, extrinsic motivators and their responses were examined for patterns. Extrinsic motivators received three main types of responses from participants: positive, neutral, or negative. Despite prior research that reported that extrinsic motivators negatively impacted student motivation and progress toward learning goals (Gillet et al., 2012), positive support for extrinsic motivators was reported by several participants in this study. In alignment with RQ1, the participant-supplied motivators were consolidated so that a single percentage could be obtained for the following subtypes of extrinsic motivation: identified regulation (19%), external regulation (18%), and introjected regulation (6%). Summarizing this information further, 43% of all participant-supplied motivators represented extrinsic motivators. Using this information combined with quotes from the interview scripts, participants' extrinsic responses could be examined in light of RQ1 to explore themes related to the extrinsic motivators embedded within an elementary-level digital mathematics instructional program and impact on motivation.

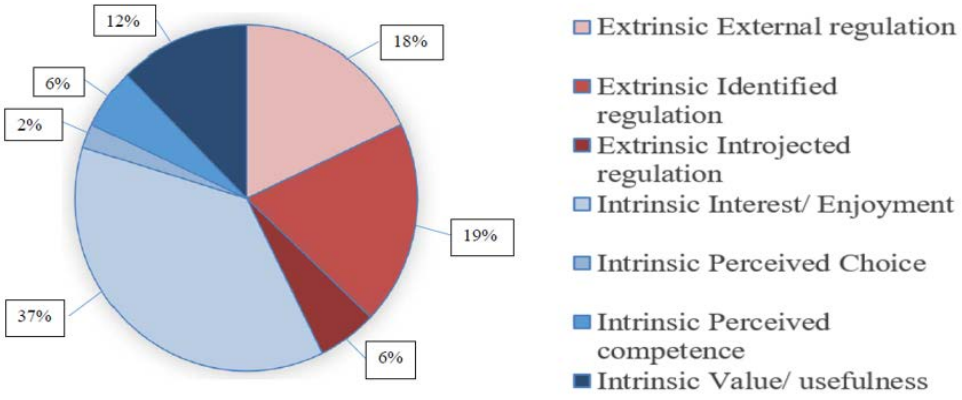

Figure 3. Participant-supplied motivators by type and subtype.

Positive responses to extrinsic motivators. Participant 4FA (personal communication, May 21, 2018) stated, "The stars help you keep going because it makes you think you're doing really good." Similarly, multiple participants reported that extrinsic rewards in the programs positively impacted their moods or attitudes. For instance, Participant 3MC (personal

communication, May 21, 2018) revealed that, “It makes me feel happy to be actually doing stuff just like the avatars make me happy to, um, do my lessons. They put me in a good mood and the games just make me happy to keep playing.” Likewise, Participant 4FE (personal communication, May 21, 2018) reported,

> Well, I don’t know if that [green light, points, buying things, and avatars] makes me what to learn more about math. It just really makes me, well, it makes me feel good to, like, get it right and get a lot of points and, like, I guess, design my avatar and get a green light.

High scores and correct answers made Participant 3MD (personal communication, May 21, 2018) “feel proud” for the sake of getting more points. Such an emphasis on scores and correct answers supported the connection identified by Reeve and Lee (2014) between motivation and achievement. Teacher imposed extrinsic rewards, outside of the gamified learning platform, were sometimes effective in bolstering motivation:

> She [the teacher] has a poster board where, if you finish all your stuff, I have, but I don’t think she’s printed it out yet, though, and she’ll put it up there so everybody can see it. It makes me feel good. Well, it doesn’t make you feel that bad because it’s fun, but it still motivates you to do better and get different things. (4FA, personal communication, May 21, 2018)

Such responses indicated that these extrinsic motivators effectively motivated the participant towards persistence in the program for the gaming and entertainment value but not for the academic learning potential. Other participants did make meaningful connections between the extrinsic rewards and academic impact. For example, Participant 4FC (personal communication, May 21, 2018) revealed that, “It [points] motivates me to learn,” and Participant 4MC (personal communication, May 21, 2018) revealed that, “it [losing a “life”] motivated me

because I wasn't, I wasn't really good at math and it motivated me to me, to learn more about math and that's how I'm as good at math right now." The impact of such extrinsic rewards, such as points, helped Participant 4FE set goals for future learning who stated, "I feel like I need to practice that more, like, the questions more, and I need to, kind of, memorize them so they'll, so I'll remember them" (personal communication, May 21, 2018). Participant 3MC (personal communication, May 21, 2018) realized that the extrinsic reward (the avatars in the program) prompted a positive impact on his mood which then led to his academic progress. This realization was stated:

> Well, the avatars put me in a good mood and then, um, I go into my lesson and just feel so good to get, like, just feels so good each time I get a question right and each time I pass a lesson. And, I think the avatars have helped me a lot. Put me in a good mood and not to just guess on everything because I've only failed one lesson, um, in what I call my TTM career. (3MC, personal communication, May 21, 2018)

Neutral responses to extrinsic motivators. Some participants saw the academic potential and impact from extrinsic rewards, such as points or scores, but responded ambivalently to the idea. For instance, Participant 4FB stated, "I learn from my mistakes, so, um, like, if I get a question wrong, I, um, like, on TTM, I look at how it, like, explains the thing to see what I did wrong" (personal communication, May 21, 2018). Participant 4MA (personal communication, May 21, 2018) was likewise neutral about the impact of extrinsic rewards when he revealed, "I don't really use it [points and avatars] that much. I just kind of, just, save the points and then when I have enough to do anything, so I just do that. I hardly ever do the avatars." This action was reinforced by Participant 5MA (personal communication, May 21, 2018) who stated that: "I feel pretty satisfied that, like, I did really good, and like got a bunch of stuff, like coins. I don't

spend them, I just keep them." Sometimes extrinsic rewards supplemented by the classroom teacher outside of the gamified program appeared to have little effect on motivation. Participant 4FA revealed, "I got a game pass because I finished, but I haven't used it yet" (personal communication, May 21, 2018)

Negative responses to extrinsic motivators. Other participants reported a negative impact on their motivation: "It's kind of hard, I don't really have a feeling. I'm just bored," (4MB, personal communication, May 21, 2018) or "I don't really care if I do well in the program" (5MB, personal communication, May 21, 2018). Low scores or reoccurring failures in the program also appeared to negatively impact mood, attitude, or motivation;

> I feel really sad about it, and I don't really care, um, about the Reflex games cause I get a bunch of questions wrong and I'm used to it, but when I get questions wrong on the TTM lessons, even after I get a good mood from the avatars, I don't really like it. (3MC, personal communication, May 21, 2018)

As an overall trend, extrinsic motivators did appear to have an impact on motivation within the context of gamified mathematics instructional programs. This impact appeared to be tied to mood and program success. If participants did well in the program, then the extrinsic motivators made them happy. If participants did not do well in the program, then the extrinsic motivators caused a negative response. When faced with failure in the program, participants indicated that the extrinsic motivators either did not stimulate them or their negative responses to failure could not be counteracted by the extrinsic motivator.

Research Question 2. To best address RQ2, intrinsic motivators were also reviewed. In contrast to extrinsic motivators, responses appeared to be less polarized. In alignment with RQ2, the participant-supplied motivators were consolidated so that a single percentage could be

obtained for each subtype of intrinsic motivation: interest/enjoyment (37%), value/usefulness (12%), perceived competence (6%), and perceived choice (2%). These percentages were graphically represented in Figure 3. Summarizing this information further, 57% of the responses represented intrinsic motivators. Using this information combined with quotes from the interview scripts, participants' intrinsic responses were examined for emotional response. The researcher explored themes that were identified relating to intrinsic motivators embedded within an elementary-level digital mathematics instructional program and their contribution to motivation.

Fun/enjoyment subtype of intrinsic motivation. From the data, 19 of the 20 interview participants reported that the gamified digital mathematics programs were "fun" and they enjoyed playing the "games." The one participant who did not share this response was reluctant to respond to any of the interview questions and contributed less than 80 total words in his entire interview. The large number of participants who reported the "fun" factor accounted for 95% of this study's participants and was comparable to Laskaris' (2014) findings that 90% of learners described gamified programs as "fun." Interest and enjoyment, as a subtype of intrinsic motivation (Legault, 2016), demonstrated the most prolific response as indicated in Figure 3. A theme identified implicitly and explicitly throughout the majority of the interview scripts was supplied by Participant 4FA who stated the following: "Games seem to make them [the programs] seem more fun" (personal communication, May 21, 2018). This statement supported Nakamura and Csikszentmihalyi's (2003) findings that interest and personally assigned value was related to engagement and motivation. The gaming feature motivated reluctant participants to participate in the games:

> You have to answer math facts but it's still a game . . . I sometimes, kind of, don't like math, but sometimes on certain parts of it, I like doing math . . . I love doing math facts a

> lot, and the part that you have to do in the game. (3FC, personal communication, May 21, 2018)

Value/usefulness subtype of intrinsic motivation. Some participants were able to elevate their motivation to a point of altruism and willingness to extend their success to others. For example, Participant 4FC stated that, "If we got the question right and then see how we can help each other. Like, how they got it wrong, like, pinpoint, like, how do you get it wrong and how, like, what the right answer would be" (personal communication, May 21, 2018). This willingness to help connected with value/usefulness, as a subtype of intrinsic motivation, when the participant then made the connection to their own benefit after being prompted to reflect on how helping others made her feel. This connection was indicated by Participant 4FC who stated, "I usually say it makes me happy, but then I say it sort of helps me. So, I'm happy and it helps me. Feel like I'm interested and happy and I'm interested" (personal communication, May 21, 2018).

Intrinsic motivation dependent upon success. Not all responses were positive. Like the responses for extrinsic rewards, the motivational impact of progressing through levels, as a gamified example of perceived competence, was somewhat based on the participant's success. When Participant 4MB (personal communication, May 21, 2018) was successful in achieving higher levels, he felt "excited and proud." When he was not successful, he felt guilt and pressure and stated, "I feel like my mother just gonna tell me over and over again, do more" (4MB, personal communication, May 21, 2018). In this situation, a previously intrinsic motivator, or the desire for self-efficacy (Ryan & Deci, 2000) was threatened by the extrinsic motivator of introjected regulation (Deci & Ryan, 2000). Whereas existing research supported gamification as a strategy to increase skills and content mastery (Hanus & Fox, 2015) and bolster feelings of

confidence (Oskar et al., 2014), Participant 4MB demonstrated that such a connection is somewhat dependent upon the success, or lack thereof, that the participant experienced.

Clarifying the phenomenon. Responses to the final two clarifying questions provided a brainstorm of future opportunities for exploration. As the questions were designed to push participants into the hypothetical realm, responses were difficult to compare. Each response was considered individual and was compiled into a cohesive list of program modifications. Responses ranged from satisfaction in the current programming. Participant 3FB revealed that, "I wouldn't change anything. I like it how, the way it is" (personal communication, May 21, 2018). When questioned about specific programming improvements, Participant 4FC revealed the following information:

> Making those so you feel like an actual game. Except for Reflex, TTM I really do like want to change it into like more of a game. So, like, if we were doing money, say that, the whole lesson would be like, like put this, this there and then put it into like, so it's a game where you can like. It's sort of fun but then it's also, you're learning at the same time. (personal communication, May 21, 2018)

Despite the range of responses, some trends emerged. Generally speaking, participants wanted more gamified components and less mathematics content. Although the information provided in the clarifying questions of the interview protocol did not specifically address this study's purpose or research questions, the data did relate to this study's problem statement and prompted an opportunity for future study and practical implications to be further discussed in Chapter 5. The findings of these clarifying questions were presented in Table 6.

Overarching research question. Data analysis and synthesis are two unique processes that form two sides of the same coin (Ritchey, 1991). The process of analysis involves breaking

information down to understand its parts and the process of synthesis involves combining pieces of information to build meaning (Ritchey, 1991). Whereas the prior sections of this study have analyzed the data by theme, this section will synthesize the information to address the overarching research question.

Table 6

Participant-supplied Modifications to Gamified Programs

Participant-supplied change	Frequency
Fewer questions	4
More game-like	4
No change	2
Different game rules	2
More incentives such as points or coins	1
Increase question response time	1
Different games	1
Less embedded math	1
More rigorous questions	1
More games	1
More embedded content support	1
Lower “prices” in the game shop	1

Note. $N = 20$.

Based on participants’ responses during the interview portion of this study, intrinsic motivators, particularly the ability to have fun, learn, and even help their peers, were primary contributors to overall levels of motivation. Additionally, the less polarized emotional response from intrinsic motivators as compared to the extrinsic motivators, prompted participants to report that they would persist activity in the programs. Participants connected this persistence to their personal enjoyment instead of being motivated by success or failure in a program. These findings were consistent with literature that supported the relationship between intrinsic motivators and overall levels of motivation to increase persistence in a task (Looyestyn et al., 2017; Van Nuland et al., 2012; Yoke Seng et al., 2015).

To further analyze the data presented in this study, Table 7 presents the nine subtypes of extrinsic and intrinsic motivation: interest/enjoyment, perceived competence, effort/importance, perceived choice, value/usefulness, intrinsic motivation, external regulation, introjected regulation, and identified regulation. Subtypes of motivation are presented in Table 7 in order from highest scoring impact to lowest scoring impact so that motivators can be compared by subtype for overall trends. Table 7 further reinforces that motivation and human behavior are directly impacted by a combination of intrinsic and extrinsic motivators and not by one type of motivation over the other (Deci & Ryan, 1985).

Table 7

Compiled Data by Subtype of Motivation

Subtype	Frequency
Interest/enjoyment (I)	33
Identified regulation (E)	17
External regulation (E)	16
Value/usefulness (I)	11
Introjected regulation (E)	5
Perceived competence (I)	5
Perceived choice (I)	2
Intrinsic motivation (I)	No data
Effort/importance (I)	No data

Note. $N = 20$ for data producing sample.
[a] Subscales are presented in order of frequency from highest to lowest. [b] Each subscale is identified as (I) for intrinsic or (E) for extrinsic.

All interview scripts indicated at least one expressly identified motivator, either extrinsic or intrinsic. Table 5 illustrated the variety of types and subtypes of motivation provided as examples by the participants. Table 7 and Figure 3 compiled these results into the nine subtypes of motivation: interest/enjoyment, perceived competence, effort/importance, perceived choice, value/usefulness, intrinsic motivation, external regulation, introjected regulation, and identified regulation. Table 7 demonstrated that participants' behavior required a combination of intrinsic

and extrinsic motivators. Specifically, although intrinsic motivators were more prevalent and created the largest impact, the distribution of motivation types did not clearly stratify by extrinsic and intrinsic motivations.

All data produced by this study indicated that both intrinsic and extrinsic motivators had some measurable impact upon participants' self-reported levels of motivation. Intrinsic motivation, as a type of motivation (as opposed to a subscale), was most frequently reported during the study. However, there was no clear pattern of extrinsic versus intrinsic motivators impacting where the other does not. Also, the subtypes of intrinsic and extrinsic motivation, when ordered from highest score to lowest score, did not indicate any particular order by motivation type or subtype. Contrary to other research that proposed that extrinsic motivators may adversely impact motivation (Gillet et al., 2012), this study found that gamified elements, both extrinsic and intrinsic, did not negatively impact participants' self-reported levels of motivation. Furthermore, if extrinsic motivators were to have a negative or at least less positive impact on motivation, the researcher would have expected for extrinsic motivators to dominate the lower end of the sorted list. However, the lowest ranking subtype was intrinsic. No pattern was presented by the data to indicate that conclusions could be isolated to intrinsic or extrinsic motivators. The data produced by this study reinforced that human motivation was best illustrated as a continuum of extrinsic to intrinsic motivators and could not be attributed to exclusively one type of motivator over another (Deci & Ryan, 1985; Ryan & Deci, 2000).

Unexpected data. The researcher found that most of the data obtained by this study was aligned with the self-determination theory (Deci & Ryan, 1985) and was consistent with other research studies exploring motivation toward gamification with differing independent variables (Abramovich et al., 2013; Barata et al., 2013; Berkling & Thomas, 2013; Charles et al., 2011; de-

Marcos et al., 2014; Dominguez et al., 2013; Gasland, 2011; Goehle, 2013; Haaranen et al., 2014; Hanus & Fox, 2015; Li et al., 2013; Mayer & Johnson, 2010; McDaniel et al., 2012; Mekler et al., 2013a, 2013b; Meyer, 2008; O'Donovan et al., 2013; Turner et al., 2014; Watson et al., 2013). As discussed in Chapter 3, the small number of survey participants produced a smaller target research sample than desired. The researcher had hoped that by soliciting the entire population of students, approximately 300 students in all, a minimum of 100 students (Delice, 2010) would constitute the target research sample. A larger target research sample would have allowed the researcher to purposefully select a data producing sample that more closely resembled the population. Nevertheless, the data overall supported the constructs of self-determination theory, namely that participants were motivated by a combination of both intrinsic and extrinsic motivators unique to the participant (Deci & Ryan, 1985).

Within the data, some responses were surprising. Specifically, it was unexpected that completely opposing information was reported by participants in the two scripted clarifying (Bevan, 2014) questions. Several participants preferred a reduction in math content. For example, Participant 4MB stated that, "Maybe if it had less math stuff, well, it would be, it would be no math at all, if I did it" (personal communication, May 21, 2018) and other participants like 3FA, 4FA, and 3FE requested fewer questions. But, some participants wanted more quality math content as indicated by Participant 5FA who stated, "I think I would like it more if it was more than just facts and doing fraction stuff and stuff like that and then learn facts" (personal communication, May 21, 2018). Participant 3MA reinforced the emphasis on academics by stating, "If you get multiple right, you should get questions that are harder over time" (3MA, personal communication, May 21, 2018). Participant 3MB suggested more strenuous rules to the program. More specifically, the participant revealed that, "I would change

that, if you get, miss two questions, you, if you miss two or more questions, you don't pass the lesson" (3MB, personal communication, May 21, 2018). The responses toward the games included changing the games completely (4MA, personal communication, May 21, 2018), having different game rules (4MC, personal communication, May 21, 2018), and adding more game-like components (3FA, personal communication, May 21, 2018). The lack of consistency across the interviews during the clarifying portion of the interview was unexpected considering that the same participants reported consistent responses during other portions of the interview, namely the six apprehension (Bevan, 2014) questions.

Trustworthiness of the data. The researcher strategically planned a variety of techniques and strategies to preserve the trustworthiness and rigor of the data generated by this study. In consensus with Polkinghorne (1989) who suggested that phenomenological studies consist of five to 25 different interviews from individuals who have experienced the same phenomenon under investigation, this study resulted in an acceptable number ($N = 20$) of data producing interview participants. Additionally, the range of participants extended across all three grade levels (third, fourth, and fifth) and included male and female participants. Although this distribution did not mirror the anticipated numbers of three males and three females per each of the three grade levels, the participants did adequately represent the student population.

To ensure credibility of the data, member checking was used to verify understanding and interpretation (Merriam, 2009; Simpson & Quigley, 2016). Interviews were audio recorded and transcribed with all word choice and order preserved. The researcher did not collect or record participant names for the survey or interviews and did not ask for personally identifying information in an effort to preserve anonymity (Gill et al., 2008; Whelan, 2007).

A study is only considered reliable to the degree that it can be replicated (Delice, 2010). The ability to replicate a study with consistent findings was considered to be one of the most important factors of a research study with regards to quality and rigor (McNeil & Chapman, 2005). The repeatability of this study was dependent upon a data producing sample that could be replicated (Henn et al., 2006). Since the findings of this study aligned with the constructs of the theoretical framework guiding the study, the researcher assumed that a similar population and sample size would yield reliable findings in future studies.

Findings relative to relevant literature. Although this study did present findings that supported the self-determination theory (Deci & Ryan, 1985), some of the studies examined by the literature review either conflicted or supported this study's findings. Whereas Wigfield et al. (1998) examined internal versus external motivators and determined that social affirmation and respect was more influential on motivation than a focus on performance goals, this study did not reflect such a preference. Table 5 indicated that performance goals, as reported by the participants as scores (12.4%), learning (11.2%), and bonus rounds (5.6%) consisted of 29.2% of the total reported motivators. In contrast, social affirmation and respect, as reported by the participants to either be bragging to friends (3.4%) or competing with friends (1.1%) comprised 4.5% of the total reported motivators. These findings directly contradicted Wigfield et al. (1998). The findings of this study also contradicted the idea that extrinsic motivators effectively decreased motivation while intrinsic motivators positively impacted learning, performance, and enjoyment (Gillet et al., 2012).

The findings of this study aligned to the constructs of the self-determination theory. Self-determination theory was a dualistic theory regarding motivation because it proposed that a combination of intrinsic and extrinsic motivators affected human behavior (Reiss, 2012). Based

on the combination of its three main constructs (i.e., autonomy, self-efficacy/competence, recognition/relatedness), the theory asserted that motivation was increased by a blend of intrinsic and extrinsic motivators unique to the individual and to the task (Deci & Ryan, 1985). The data presented by this study indicated this same phenomenon. The researcher found that different components of gamification motivated participants for different purposes and that both intrinsic and extrinsic motivators contributed to high levels of self-reported motivation. Components of this study aligned with the results from other studies that also found a positive connection between gamification and student engagement (da Rocha Seixas et al., 2016; Griffiths, 2014; Ibanez et al., 2014; Leaning, 2015; Looyestyn et al., 2017).

In consensus with the concept that student motivation was a necessary component to student engagement and was a requirement for skill retention (Taheri et al., 2015), the findings from this study suggested that gamification is an effective motivator when embedded in digital mathematics programs. Although the study did not focus on academic progress, several participants reported during the interview phase that the gamified programs offered them an opportunity to learn and improve their math skills. Participants reported high levels of value/usefulness from the learning component with 12% of participant responses directly relating to the programs' value and usefulness (see Figure 3). Similarly, the study agreed with Nakamura and Csikszentmihalyi (2003) which determined that engagement was tied to interest in the activity. Within this study, the subtype interest/enjoyment was similarly reported with the highest frequency during interviews with 37% of responses connected to interest (see Figure 3).

Chapter Summary

The findings of this study were reviewed and analyzed within this chapter. To set the context for the study, detailed descriptions of the participants and study setting were presented.

Then, a discussion of the preparation of the data included the process of recording, transcribing, and coding interview scripts. The coding processes detailed in this chapter were used to disaggregate and quantify information within the interview scripts. Participant responses throughout each script were identified as either intrinsic or extrinsic according to the nine subtypes of motivation. Responses were then compiled by subtype and type of motivation; all motivators were impactful toward motivation. Intrinsic motivation and identified regulation, the most autonomous of the types of extrinsic motivators (Deci & Ryan, 2000), demonstrated the highest overall impact. Regarding RQ1 and RQ2, participants reported a polarized emotional response to extrinsic motivators, either being very motivated or discouraged dependent upon success or failure. Alternatively, participants reported a predominantly positive emotional response to intrinsic motivators, particularly in the two subtypes of interest/enjoyment and value/usefulness. In general, Figure 3 indicated that participants reported a higher frequency of intrinsic motivators than extrinsic motivators.

After presenting and analyzing the data generated by this study, Chapter 5 will continue the discussion by summarizing the major findings, drawing conclusions, interpreting findings, and discussing the implications of the study. Chapter 5 will then combine the findings presented and analyzed in Chapter 4 to produce a summarizing analysis designed to discuss and address the components of the overarching research question that focused the exploration of this study. Conclusions and interpretations of the findings will lead to a discussion regarding the implications of the study. Additionally, Chapter 5 will suggest areas for future research followed by a discussion of the limitations and reflexivity issues impacting the study that might be considered in future studies. A chapter summary concludes both the discussions contained within the chapter and presents a reflective review of the study as a whole.

Chapter 5: Summary, Conclusions, Implications, and Suggestions for Future Research

Chapter 5 presents a comprehensive review of this research study. The chapter provides a summary of the study by stating the phenomenon under investigation, the purpose statement, the overarching research question and corresponding research questions proposed, the selected methodology, the theoretical framework, and the major findings. The researcher then uses the major findings from the data analysis of the study to present this study's conclusions. Interpretations of these findings are presented before the researcher discusses critical implications of the study. Based on the study's findings and implications, suggestions for future research are presented to extend and build upon the work. After a discussion of the identified limitations and issues regarding reflexivity of the study, the researcher shares self-reflective comments about the journey she experienced while conducting this study. The chapter closes with an summary of the entire study.

Summary and Major Findings

Some traditional approaches to mathematics instruction have led to decreased interest and motivation of student engagement (Bishara, 2018). This study endeavored to address the phenomenon of increased gamified technology usage within an educational context (Kroski, 2013) and its impact upon motivation. Internet-sourced games have risen in usage by teachers who reported that students were more willing to persist with a challenging task when a gamified approach was presented (Kroski, 2013).

The literature depicts a widespread phenomenon where nonacademic video games are pervasive throughout contemporary culture (Posey Norris & Altevogt, 2015). In consensus, Erenli (2013) reported that 97% of school-age children play video and/or computer games. Video games for pleasure (Simoes et al., 2013) were reported to produce a high impact upon student

motivation (Haskell, 2012). Gamification in an academic context, particularly when embedded in digital mathematics instructional programs, may have a different impact upon levels of student motivation than nonacademic video games. Several studies (da Rocha Seixas et al., 2016; Griffiths, 2014; Ibanez et al., 2014; Leaning, 2015; Looyestyn et al., 2017) have explored the connection between gamification and engagement. Contrary to previous studies, this study focused on motivation instead of engagement. Motivation is "the level of effort an individual is willing to expend towards the achievement of a certain goal" (Brennen, 2006, para. 3). The driving force behind motivation is an individual's "willingness" to persist in a specified task or behavior (Kroski, 2013; McDevitt & Ormrod, 2006).

The purpose of this qualitative study was to identify how intrinsic and extrinsic motivators embedded within gamified digital mathematics instructional programs contribute to motivation levels of third- through fifth-grade students at an elementary school located in central Texas. Self-determination theory was used to guide the focus of the study toward the constructs of autonomy, self-efficacy/competence, and recognition/relatedness (Ryan & Deci, 2000). These constructs were used to develop an interview protocol which was used to determine whether the gamified elements found in digital mathematics instructional programs related to motivation. An interpretative phenomenological qualitative methods design was used. Using a convenience sampling approach, students were invited, pending parental consent and student assent, to complete an electronic survey requesting demographic information. The results from this survey identified a target research sample. From this target research sample, purposeful sampling was used to identify a data producing sample. The researcher conducted one-on-one, semi-scripted interviews utilizing Bevan's (2014) three-part interview structure to collect data. Research questions were written to address the theoretical framework of this study and the overarching

research question framing this study. Findings across 20 interview scripts were combined to address the research questions presented by this study.

This study identified the following theory based overarching research question: To what extent and in what ways do gamified components embedded in an elementary-level digital mathematics instructional program contribute to students' motivation levels? This overarching research question was used to develop the following two research sub-questions:

RQ1. Which extrinsic motivators embedded within an elementary-level digital mathematics instructional program contribute to student motivation?

RQ2. Which intrinsic motivators embedded within an elementary-level digital mathematics instructional program contribute to student motivation?

An electronic survey consisted of a participant assent page and four demographic questions which were used to determine eligible participants. In the survey, these eligible participants indicated grade level and whether they participated in a digital mathematics instructional program at least once per week. At the conclusion of the survey phase, 38 responses were received which produced a target research sample. From this target research sample, the researcher conducted one-on-one interviews with 20 participants as the data producing sample. The interview phase of this study sought to explore the connection between gamification and motivation. Specifically, the interviews were used to explore which specific extrinsic and intrinsic motivators were influential on participants' motivation levels. Using a semi-scripted format following Bevan's (2014) interview structure, 11 questions were developed to follow a pattern of contextualizing the issue, apprehend the phenomenon under investigation, and clarify for concept extension. These scripted questions were supplemented with impromptu questions that arose in response to participants' specific answers to the scripted questions. In all, 20 scripts

were collected. These scripts were then coded and analyzed to extract meaningful patterns and direct quotes. From this data, the researcher listed 15 unique gamified motivators that the participants identified from several digital mathematics instructional programs they had interacted with at school. These 15 motivators were categorized by extrinsic or intrinsic motivation. Upon analysis of the frequency of specific motivators across scripts, 57% of the participant-identified specific motivators that positively influenced their motivation toward gamified learning programs were intrinsic. Conversely, 43% of the participant-identified specific motivators were extrinsic.

Participants' quotes were used to further explore the extrinsic and intrinsic motivators identified by participants as well as their emotional response to each motivator. From the range of quotes captured, the researcher concluded that extrinsic motivators produced more polarized emotional responses. When the participant felt successful, the extrinsic motivators were perceived positively. When the participant felt frustrated or unsuccessful, the extrinsic motivators negatively influenced the participant's desire to persist in the gamified programs. Alternatively, intrinsic motivators were more stable in emotional response. The interest/enjoyment subtype of intrinsic motivation was reported by 95% of the interview participants. Furthermore, the "fun" factor was able to sustain participants through both successful and unsuccessful experiences within the gamified programs to the point that they were willing to persist in the program. Persistence was connected to the potential learning experience for the participant or the opportunity to help other students in their class toward mathematics skill mastery.

Not all of the responses toward intrinsic motivators were positive. For example, while success in the program provoked feelings of pride and excitement, failure in the program

prompted stress and guilt due to concern about others' (e.g., parents, teachers, friends) responses to the failure. In this example, an intrinsic motivation (self-efficacy) could be adversely affected by an extrinsic motivator (introjected regulation; Deci & Ryan, 2000; Ryan & Deci, 2000). Such a contradiction introduced the idea that extrinsic and intrinsic motivators could intertwine.

When combining data from the interview scripts, the researcher identified that self-reported levels of motivation were impacted by both intrinsic and extrinsic motivators. Although the extent to which a particular type of motivation impacted motivation varied widely, all subtypes produced positive anecdotal quotes from at least some of the participants. The mixture of intrinsic and extrinsic motivators to impact motivation aligned with the theoretical framework guiding this study. Self-determination theory is dualistic because it proposes that both intrinsic and extrinsic motivators impacted behavior (Reiss, 2012). Based on the combination of its main constructs (i.e., autonomy, self-efficacy/competence, recognition/relatedness), self-determination theory asserted that humans utilize a mixture of intrinsic and extrinsic motivations to guide behavior (Deci & Ryan, 1985). The data presented by this study aligned with the constructs presented by self-determination theory.

From the data generated by this study and the subsequent analysis that took place, the researcher concluded that gamified elements embedded within a digital mathematics program positively impacted self-reported levels of motivation. Although different elements of gamification produced different responses across types (intrinsic or extrinsic) and subtypes (interest/enjoyment, perceived competence, effort/importance, perceived choice, value/usefulness, intrinsic motivation, external regulation, introjected regulation, and identified regulation), all participants' responses indicated a positive connection between gamified components in digital mathematics instructional programs and motivation. Likewise, the data

produced by this study indicated that a variety of motivators and gamified elements contributed positively to levels of motivation.

Conclusions

The findings presented by this study connected logically to self-determination theory which was used as the theoretical framework to guide this research endeavor. Self-determination theory purports that an individual's behavior is directly impacted by a combination of both intrinsic and extrinsic motivators (Deci & Ryan, 1985). Based on this concept, this study endeavored to explore the application of this concept to gamification within digital mathematics instructional programs. In alignment with the theoretical framework selected, the data led the researcher to conclude the following:

- Participants' levels of self-reported motivation were impacted as a result of gamified elements embedded within mathematics instructional programs;
- Motivation, while interacting with a gamified instructional learning program, was impacted by a combination of intrinsic and extrinsic motivators;
- The combination of intrinsic and extrinsic motivators varied by participant and was unique to each participant; and
- Participants were able to identify specific motivators that influenced their levels of motivation and, ultimately, engagement toward a digital mathematics instructional program.

Building on previous research that indicated a rise of entertainment video games (Erenli, 2013; Posey Norris & Altevogt, 2015) and a connection between gamification and increased engagement (da Rocha Seixas et al., 2016; Griffiths, 2014; Ibanez et al., 2014; Leaning, 2015; Looyestyn et al., 2017), these concluding statements proposed that gamification in academic

contexts positively impacts motivation. Combining the findings of this study with prior research yielded a deeper understanding of the potential impact of gamification in education. Furthermore, the researcher used the qualitative interview data to conclude that the academic nature of gamified mathematics programs may have contributed to levels in motivation. Table 7 indicated that 50% of interview participants reported that “learning” was a motivating factor of the gamified mathematics program. Learning was categorized as an intrinsic motivator under the subtype of value/usefulness. This conclusion is noteworthy in light of Tatar et al. (2015) who found that anxiety from learning mathematics is typically tied to negative experiences. Gamification in digital mathematics instructional programs provided a positive and motivating experience; this study concluded that issues regarding mathematics anxiety may be reduced or partially prevented when students participate in a gamified mathematics instructional program.

These conclusions were derived in response to the study’s attempt to answer the research questions. After developing the overarching research question and corresponding research sub-questions aligned to this study’s theoretical framework, data gathered were used to provide meaningful conclusions that could be directly applied to the education industry. With the knowledge that participants reported a connection between gamified elements embedded within a mathematics instructional programs, using these programs can be a meaningful part of classroom instruction and skill reinforcement.

Delving further into the findings of this study, with the understanding that the study participants responded positively to a combination of intrinsic and extrinsic motivators, educators and program developers can develop digital mathematics instructional programs that integrate both types of motivators in lieu of focusing exclusively on intrinsic or extrinsic motivators. Finally, using direct quotes from participants regarding the specific motivators

embedded in gamified programs provide meaningful feedback for educators and program developers. This feedback is critical for prioritizing which gamified elements to include or focus on when developing or implementing a digital mathematics program within the classroom curriculum.

Interpretations of Findings

The context of this study was derived from the researcher's personal observations. Whereas the researcher observed students in both educational and social contexts willingly choosing to play on their personal gaming devices, those same students often resisted participating in the digital mathematics instructional programs assigned by the school. These observations led the researcher to question what components of the digital games exclusively for enjoyment/fun were absent from the academic digital games that the teacher assigned. The researcher began to explore different theories regarding motivation that might be used to frame the study and provide context for the researcher's field observations. Upon identifying self-determination theory (Deci & Ryan, 1985), the constructs of self-efficacy/competence, autonomy, and recognition/relatedness began to align well with features of gamification (Reeve & Lee, 2014). Further research regarding self-determination theory along with other studies that utilized self-determination theory as the theoretical framework (Gillet et al., 2012; Guay et al., 2010; Kanat-Maymon et al., 2015; Reeve & Lee, 2014) prompted the researcher to outline the purpose of this study. In this study, the researcher identified that intrinsic and extrinsic motivators and the combination of both were the primary determinants of motivation in alignment with self-determination theory (Deci & Ryan, 2008; Reeve & Lee, 2014).

Initially, the researcher posited that choice and autonomy were primary factors in the her previously observed disconnect between a desire to play commercial video games in lieu of

academic digital games. After conducting this research, the data in this study indicated a different emphasis. Whereas the researcher assumed that participants would report autonomy and choice, both intrinsic motivators (Deci & Ryan, 1985, 2000, 2008), with high frequency, the data indicated that perceived choice was the lowest rating subscale and received only 2% of the student responses. Kinney and Robertson (2003) presented technology as an opportunity to provide choice and autonomy for students; however, this study did not support the conclusion that students self-reported a significant impact on their levels of motivation when presented with choice. These findings also directly contradicted the researcher's own assumptions. In speaking with the study site principal to understand the setting under investigation, the researcher learned that participation in the digital mathematics instructional programs selected by the site was not optional (J. Choate, personal communication, April 25, 2018). Additionally, participation in a digital mathematics program was an eligibility requirement for students to participate in the study. As such, the researcher made the assumption that choice, as a motivator, was less impactful than expected (Kinney & Robertson, 2003) because the participants sampled did not have an opportunity or expectation of choice. This caused the researcher to wonder if students would choose a digital mathematics instructional program over other methods of instruction (e.g., direct instruction, tutoring, nondigital games, etc.) if given a choice. Such a question is presented along with other possibilities later in this chapter when suggestions for future research are presented.

Instead, the interest/enjoyment subscale was highly reported by participants. The interview scripts produced the highest rating for interest/enjoyment elements which was identified in 37% of the responses. Engagement refers to an individual's emotional, behavioral, or cognitive response to a task (Fredricks et al., 2004). Several studies (da Rocha Seixas et al.,

2016; Griffiths, 2014; Ibanez et al., 2014; Leaning, 2015; Looyestyn et al., 2017) have explored the connection between gamification and engagement. Increased levels of interest and enjoyment, as reported by this study, contributed to higher levels of engagement (Ryan & Deci, 2000). Likewise, the combination of motivation and engagement has been shown to positively impact student achievement (Reeve & Lee, 2014). As such, the conclusions of this study aligned with self-determination theory and supported the findings from other studies (da Rocha Seixas et al., 2016; Griffiths, 2014; Ibanez et al., 2014; Leaning, 2015; Looyestyn et al., 2017). Additionally, the findings of this study explained the researcher's preliminary observation that students were more motivated by commercial video games (Haskell, 2012) than academic digital games. The highest motivating factor was not perceived choice, as initially supposed, but rather personal enjoyment (Simoes et al., 2013).

Implications of the Study

This study was developed to specifically explore the impact that gamified elements embedded within a digital mathematics instructional program might have upon self-reported levels of motivation. Other studies have explored the connections between engagement and gamification (da Rocha Seixas et al., 2016; Ibanez et al., 2014; Leaning, 2015; Looyestyn et al., 2017); however, this study resolved to explore the connection between motivation and gamification. As such, the findings of this study can be applied in several different contexts to impact the development of future theories, program development, and educators in the field.

Implications for theory development. Whereas self-determination theory was developed to encompass human motivation toward any behavior, this study provided a specific context wherein the theory could be applied. Context, including population and unique characteristics of the sample, was what delineated this study from other studies that have been

grounded in self-determination theory (da Rocha Seixas et al., 2016; Griffiths, 2014; Ibanez et al., 2014; Leaning, 2015; Looyestyn et al., 2017). This study focused on elementary students specifically within the context of mathematics instruction which was an area of study not previous explored. In contrast with previously conducted research explored other factors such as age, gender, and impact on behavior from a second- or third-person perspective (Arning & Ziefle, 2007; Lister, 2015; Looyestyn et al., 2017; Pedro et al., 2015; Venkatesh et al., 2003; Williams et al., 2008, 2009), this study used first-person reports and narratives regarding motivation. Likewise, gamification has been explored in other contexts such as healthcare, economic sales, and survey response (Looyestyn et al., 2017), but literature had not, prior to this research study, addressed the impact of gamification in elementary-level mathematics programs upon self-reported levels of motivation. As such, the findings of this study contributed to the existing gap in literature.

Cherry (2018) discussed the power of incentives as external motivators in incentive theory (Hockenbury & Hockenbury, 2011). Much like what was determined during the data collection phase of this study, the extrinsic motivators were only motivating as long as the individual was successful (Cherry, 2018). Along the continuum of motivation from extrinsic to intrinsic (Deci & Ryan, 2000), motivators in the middle of the continuum including praise and feedback can condition an individual's own internal locus of motivation (Cherry, 2018) toward higher levels of engagement (Simoes et al., 2013). Wigfield et al. (1998) determined that social affirmation and respect had a greater impact on motivation than performance-related goals, but this study did not reflect such a preference.

In consideration of the overarching purpose of this study, this study concurred with other research that indicated that motivation was directly tied to engagement (Taheri et al., 2015). This

confirmation of a connection between motivation and gamification within the context of an elementary-age population broadened the depth of understanding and the application of self-determination theory. As theories regarding motivation continue to develop, this study can further identify nuances along the motivation continuum such as that indicated in the analysis section of Chapter 4. In sum, this study contributes to a greater understanding and application of the types and subtypes of motivation, particularly how they impact elementary students.

Implications for education policy development. As the field of gamified instructional programs grows (Erenli, 2013; Kroski, 2013; Posey Norris & Altevogt, 2015), policymakers will be looking to develop policies that govern the usage and implementation of gamified programs on a larger scale. Jung and Conderman (2015) found that technology integration positively impacted mathematics instruction, and Reeve and Lee (2014) found that motivation and engagement positively impacted student achievement. Combined, policymakers can use the findings from this study to develop policies that guide the adoption and implementation of gamified learning programs. Policies that utilize the findings from this study might include minimum requirements for engagement, motivation strategies, and impact upon achievement.

Program developers will be looking for presentation platforms that more adequately meets the needs of both the academically-focused stakeholders (policymakers, administrators, teachers, and parents) and interest-focused stakeholders (students and teachers). As presented in Table 6, the interview participants provided a wide variety of suggestions that could improve existing or future programs. One such idea was to make future programs even more game-like with less obvious content. Participant 3FD (personal communication, May 21, 2018) framed this idea as “Whenever you are just answering the fact, it’s kind of boring . . . But when there are games on there and all that stuff, it just makes you forget about how boring the facts are.” By

using the findings of this study to further identify specific motivating gamified components, future programs can be developed to more fully motivate students while still providing the necessary academic content. As concluded through the interpretation of this study, program developers should place emphasis on interest and enjoyment when developing digital instructional programs.

Choice, according to self-determination theory, is a critical component of motivation (Deci & Ryan, 1985, 2000, 2008). Many of these programs removed an element of choice by asserting that regular, repeated, and consistent program usage is necessary for teachers and school administrators to expect measurable academic growth (Imagine Math, 2018). In return, schools similar to this study's site mandate participation in the digital gamified mathematics programs that are offered (J. Choate, personal communication, April 25, 2018). Since motivation ties directly to willingness to persist in a behavior or task (Kroski, 2013; McDevitt & Ormrod, 2006), program developers that focus on the "fun" component can expect students to more willingly participate in the program.

Implications for pedagogical practice. Within the scope of professional practice, this study provides several opportunities for improvement in student motivation strategies. Motivation strategies are regularly used to engage learners (Griffiths, 2014). This study outlined and ranked specific intrinsic and extrinsic motivators as self-reported by the participants. As such, educators may use the data and findings presented by this study to support integration of gamified mathematics instructional programs within their existing curriculum.

Furthermore, educators will have knowledge of the specific student responses to certain motivators and can modify classroom emphasis accordingly. For example, whereas a teacher, like the researcher, might perceive student choice to be an effective motivator, this study did not

support such a conclusion. Instead, educators can prioritize a fun and engaging learning environment for the students and expect higher levels of student motivation.

Finally, this study was developed as a direct result of the researcher's observations of student behaviors in the learning environment. Similarly, educators can be encouraged to solicit student feedback (Cherry, 2018) before modifying the learning environment in an attempt to increase student motivation towards a learning task. As demonstrated by this study and other supporting literature (Guay et al., 2010), elementary-age students are capable of self-reporting levels of motivation. Therefore, students' first-person perspectives should be considered when planning motivational strategies in the classroom.

Unexpected study outcomes. Although the current study began a relevant discussion regarding students' self-reported levels of motivation toward gamified mathematics programs, the study was intentionally limited in scope. The admittedly small target research sample size (N = 38) indicated that the findings and subsequent implications of this study would be better served by a larger target research sample size to provide more relevant and transferable findings. Despite the limited target research sample size, the data producing sample size (N = 20) was of an acceptable size (Polkinghorne, 1989). The number of interviews conducted relative to the target research sample size led the researcher to confidently assert that the findings are representative of the participating population. However, the data suggested trends that might be applied to the general population. For this reason, this study could be completed again but using methods such as a longer sampling timeline with increased parent communication (e.g., offering informational meetings for parents) to solicit a larger target research sample population.

Suggestions for Future Research

The ideas explored by this study related to the theoretical framework of self-determination theory (Deci & Ryan, 1985) and linked to student motivation spurred several additional avenues for future research. A future research study could explore the impact of cultural norms by comparing levels of self-reported motivation by fifth-graders in an elementary school setting to fifth-graders in an intermediate/transitional school setting. By limiting the population to fifth-graders, thereby reducing variables and introducing setting as a variable, a study could be developed to compare one set of attitudinal impressions to another set of attitudinal impressions.

Another potential research study could explore grade-level clusters by exploring and comparing the levels of self-reported motivation as expressed by third- through fifth-grade elementary school students, sixth- through eighth-grade middle school students, and ninth- through 12th-grade high school students. Although age would be an embedded variable in this research design, instructional setting, delivery, and grade clusters could each be explored as possible contributors to student motivation. Such a study would build on the existing work of Gillet et al. (2012) who found that motivation tended to decrease with age and Tatar, Yılmaz, and Türkan Berrin (2015) who found that mathematics anxiety was typically tied to negative experiences. The aforementioned researchers presented that as time progressed, the opportunity for a student to experience negative situations involving math instruction would be more abundant. Combining the research from these two and other related studies, a longitudinal study of the same students or comparisons of similar populations within each grade cluster could broaden both the understanding of student motivation relative to gamification as well as explore the impact of age and time on gamification-related motivation levels.

This study entirely focused on self-reported levels of motivation and did not include the motivations or perspectives of others. The researcher found that many stakeholders have opinions and perceptions regarding gamification in the instructional setting. During the course of soliciting research participants and while explaining the purpose of this study, teachers have contributed their ideas regarding how to motivate students, classroom strategies to increase motivation, and their perceptions of students' responses toward gamified learning programs. Similarly, parents have expressed their opinions (positive and negative) towards digital program usage in the classroom. A future study might explore the perceptions of student motivation by teachers and/or parents and compare them with those perceptions to those levels of motivation expressed by students at the same site. Further, studies could also compare adults' perceptions of gamified learning with students' perceptions of gamified learning within the same instructional context.

Kinney and Robertson (2003) determined that technology impacted intrinsic feelings of choice and autonomy. As discussed in the interpretations section of this chapter, this study found that the subtype of motivation regarding choice/autonomy produced relatively low qualitative data compared to other subtypes of motivation. After the researcher discussed the instructional setting with the site principal, the researcher learned that participation in the digital mathematics programs selected by the study site was not optional. Future research might explore the concept of student choice. After being exposed to a variety of instructional settings including direct instruction, small group instruction, tutoring, digital games, and non-digital games, students could be queried about their choice for future instructional settings to determine the impact that choice has upon motivation as compared to the findings presented in this study.

One additional possible study would be a longitudinal experimental design. The purpose of such a study would be to extend the research of this study to measure the persistence of motivation of the sample as they progress into middle/high school, with and without continued gamification. Specifically, this extension study would seek to explore if the early use of gamification predisposed, accelerated, or increased motivation towards mathematics learning in later grades. Whereas this current study did not alter instruction or the instructional setting in any way, such an extension study would require extensive cooperation with the site so that the researcher could introduce a gamified mathematics instructional setting and a nongamified mathematics instructional setting and then monitor the progress of each group of students. Despite the added logistical and site approval requirements, such a study would be able to identify potential correlations between gamification and motivation and, ultimately, student learning.

Limitations and Reflexivity

Although the current study began a relevant discussion regarding students' self-reported levels of motivation toward gamified mathematics programs, the study was intentionally limited in scope. A research design where the study included a larger target research sample of participants from a similar population could provide stronger data that more closely represented the population. This limitation was inherent in the design of the study, however, by virtue of the sampling method (i.e., a sample of convenience). The data producing sample size ($N = 20$) was an appropriate size to give credibility to the findings (Polkinghorne, 1989). As an appropriate range of participants is five to 25 (Polkinghorne, 1989), a similar N in future studies would continue to be appropriate although a future study might extend the range of grades or use grades as variable.

Other limitations arose during the data collection portion of the study. Although Bevan's (2014) semi-scripted interview structure was utilized to develop the interview protocol used by this study, the interview questions were developed by the researcher and were not subjected to an expert review. The researcher also did not subject interview questions to a field test. The researcher should have presented the interview protocol to a sample of pilot participants to vet the questions before presenting them to the data producing sample participants. In retrospect, this omission is due to the lack of experience on the part of the researcher and would have been a critical component to improve the validity and accessibility of the data collected during the interview stage. In a future study, the researcher would utilize a field test and expert review for any protocols that the researcher developed.

Time constraints and scheduling proved to be an unexpected issue. All 20 interviews were conducted in a single afternoon in an attempt to minimize the disruption to the site's master schedule and student learning. Although this timing was difficult for the researcher to manage, interviews were completed during the short timeframe because participants were relatively brief in their responses. Although participants were prompted with semi-scripted and unscripted questions, interviews lasted no more than 10 minutes each. The brevity of each interview resulted in short interview scripts with limited depth from each response. Had a field test been conducted, the researcher might have identified weaknesses in the interview questions and developed additional questions or revised the existing questions to prompt deeper responses.

A limitation not initially considered but that arose during data collection was the difficulty that the target research sample had with comprehending the vocabulary and structure of the survey and interview questions. The researcher needed to provide explanations regarding how to respond electronically and what the meaning was for specific words. Additionally, the

researcher did not anticipate participants being disinterested in the topic of gamification during the interviews. This lack of understanding or engagement may have impacted the quality of the data collected in this study. Due to the confusion that some of the directions and vocabulary created, it is the researcher's opinion that an older population might have been better suited for participation in this study. Alternatively, grade-level teachers and/or students not participating in the study but of a comparable age and grade level might have reviewed the study instruments in advance. This review could have provided the researcher with feedback regarding the accessibility and interpretation of the survey directions and interview questions. This feedback could then be used to modify delivery or verbiage within accessible limits, thereby improving participants' comprehension of the context of this study.

The researcher has learned many practical applications of this study within her own personal, professional, and scholarly practice. Personally, the researcher has learned the benefit of personal growth and self-reflection. Prior to conducting this study, the researcher considered herself to be an individual who regularly observed and questioned the world around her. After conducting this study, the researcher has learned that everything has a reason and a purpose. By searching, experimenting, discussing, and reasoning, knowledge and wisdom can be developed. With a deeper understanding of student motivation, what the researcher has learned can be directly applied to her professional practice. Having had the opportunity to gather first-person narratives from students, the researcher has had an opportunity to apply her professional expertise with real-life integration. As a school administrator and instructional leader for her staff, the observations and findings of this study have already, and will continue to, guide instructional decision-making, implementation of strategies, and motivational approach with students both within the context of mathematics instruction and throughout other contexts and

content areas. As a scholar, the researcher has learned critical thinking, analysis and synthesis skills, and has grown in her capacity to write critically. From this experience, the researcher is inspired to continue to ask questions, explore the literature, and gain understanding from the research of other scholars. From a conceptual standpoint, the researcher has learned that critical thinking is more than reading and processing information. As a critical thinker and scholarly writer, the researcher has learned how to dive deeply into a body of knowledge, ask poignant questions, and build new knowledge.

The process of conducting a research study and delving deeply into the field of existing research has been a growing experience for the researcher. The researcher acknowledges several techniques that she researched, adapted, and implemented provided effective and meaningful information (e.g., utilizing a phenomenological interviewing structure, purposeful sampling), and some approaches did not work as effectively as desired (e.g., convenience sampling, failing to conduct a field test). While the strategies that were effective strengthened this study, the researcher has learned through the less effective techniques how to build a stronger research design for future endeavors. Through this process of conducting a researcher study, the researcher has learned how to utilize the strengths of others who are more knowledgeable to strengthen her own weaknesses. The researcher has learned to deepen her critical-thinking skills, self-reflection ability, and research skill set. Whereas the researcher had acquired years of practical field experience, as the researcher journeyed through the world of scholarly work, her own capacity for knowledge, application of theory, and understanding of motivation deepened from a theoretical and practical application. Throughout this process of conducting research and writing a dissertation, the researcher has grown substantially in her professional, personal, and scholarly capacity.

Chapter Summary

Chapter 5 presented a thorough summary of the study and major findings. In response to the research questions posed by this study, data was analyzed to make several conclusions. This study concluded that participants' levels of self-reported motivation were positively impacted by the gamified elements embedded within digital mathematics instructional programs. This impact occurred as a result of a combination of both intrinsic and extrinsic motivators and not exclusively one type of motivation. The observed combination of intrinsic and extrinsic motivators to impact student motivation was expected from the application of self-determination as the theoretical framework for this study (Deci & Ryan, 2000). Interviews resulted in a compiled list of specific motivators that influenced participants' motivation. The frequency of these motivators allowed for these motivators to be ranked by type and subtype of motivation and compared across interview scripts. Ultimately, this study concluded that gamification positively impacted motivation. Based on the findings of this study connected with relevant research, gamified elements embedded within digital mathematics instructional programs did positively impact participants' self-reported levels of motivation.

The researcher then discussed her interpretations of the data in relation to the purpose of the study and relevant literature. Conclusions that emerged from this study, along with the researcher's interpretations of the data generated by this study, have the potential to impact future development or application of mini-theories within self-determination theory. These implications also have a direct impact on related theory development, policy development, current and future digital programming, and pedagogical practice. In a practical application, the findings of this study can be immediately integrated into digital mathematics instructional settings within elementary classrooms. Suggestions for future research were presented based on

additional questions and wonderings generated by the researcher and additional gaps in literature identified through the literature review. Intentional or inadvertent limitations including design flaws and oversights were discussed. A discussion of the limitations and reflexivity of the study was presented along with the researcher's self-reflective comments. The researcher then shared her personal, professional, and scholarly points of growth.

Although this study did not explore self-reported levels of motivation for students outside of a limited population and cannot be fully extrapolated past the population studied, this study aligned with self-determination theory (Deci & Ryan, 1985) and existing research. This alignment led the researcher to assume that this study's conclusions can be applied to a variety of educational contexts. In short, gamified components embedded within digital mathematics instructional programs can be expected to positively impact student motivation. Within this study, different motivators impacted students to different degrees, but all types and subtypes of motivation indicated an increase within the context of participation in a gamified learning environment.

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Appendices

Appendix A: District Administrative Regulations

District Administrative Regulation

[redacted] ISD ADMINISTRATIVE REGULATION

Board Policy:

Administrative Approval Date: June 25, 2012
REVISED DATE: December 12, 2012

TOPIC: Approval of internship/research request

The following process will be used to review an internship/research request:

1. The employee will submit the request to the Principal in writing.
2. The Principal will give the employee the Internship/Research Application and the overview.
3. The employee will submit the completed application and all requested documents to the Principal.
4. The Principal will contact the Deputy Superintendent to discuss possibilities for placement/research. If necessary, either the Principal or the Deputy Superintendent will involve other campus administrators in placement/research decisions.
5. If the internship/research is approved the Principal hosting the intern will provide the letter of agreement to the intern and include the statement from the Internship/Research Program overview (see sample letter).
6. A copy of the application and the letter of agreement will be kept at the campus and provided to the Deputy Superintendent.

District Internship/Research Program guidelines.

[redacted] ISD

Internship/Research Program

The following guidelines will be used for internship/research requests:

- The intern applicant must be a current [redacted] ISD employee and the internship/research project must be a requirement of a Masters or PhD program.
- Interns in [redacted] ISD will NOT be allowed to have a reduction of teaching duties in order to allow time during the day to fulfill the requirements of an internship/research program. This may require the internship/research project to be completed on a different campus than where the employee is currently assigned.

Intern/research project applications will be reviewed by the Principal of the campus site where the internship is requested and the Principal of the serving campus will ultimately be responsible for deciding what activities the intern will be involved in on the campus. All intern selections must be approved by the Deputy Superintendent prior to the communication of the campus Principal's decision. Principals will use the following questions as a guide:

- In your opinion, does the applicant possess the potential to become a counselor, librarian, or administrator for [redacted] and are you willing to work with the applicant to develop that potential?
- If the applicant does not work on your campus, will accommodating the internship/research project add an undue workload for your campus personnel unit that would not otherwise be required?

The following statements will be included in the Letter of Agreement (see sample letter) of all approved intern applications regardless of the origin of the application.

Each employee understands that the request to complete an Intern/Research Program will be honored following the guidelines established by the intern program.

Each employee should be aware that the internship/research portion of the year may involve duty, conference, or other advisory time and that the current workload (teaching assignments) may not be modified to allow for any additional duties that are required by the intern/research program.

That completing an internship/research program in a particular area does not in any manner guarantee future employment in that area with [redacted]

That any school time missed to attend university activities will require the use of a personal day.

Appendix B: Recruitment Tools

Email to School Staff:

April 30, 2018

Dear 3rd, 4th, and 5th grade teachers, staff, and administrators,

My name is Jennifer Hoover and I am in the process of completing my doctorate in Curriculum and Instruction through the University of West Florida. I have served as an educator and administrator in the elementary school environment for many years and have a passion for making learning relevant to students. I would like to see instruction and learning continue to develop and align to better serve our students. One way I am interested in helping this initiative is by studying the connection between gamified digital mathematics instructional programs such as Think Through Math and ReflexMath, both currently used by students at the school, and student motivation. You are being contacted today by email in the hopes that you will support the research study I am conducting.

Student participation is strictly voluntary and no incentives or penalties will be offered to student participants. The study involves two parts. First, all 3rd, 4th, and 5th grades students who return a signed parent consent form will be invited to participate in a brief survey. The survey will be delivered during the computer lab rotation already a part of your daily specials rotation. The second part of the study will be a series of one-on-one student interviews with students who volunteer to participate. These interviews will be scheduled after all eligible students complete the survey and a schedule of interviews will be disseminated to you when it has been developed. Interview will be scheduled to take place during the child's specials period so as to not interrupt core content instruction. Please see a schedule of study activities below:

- Please send letters home today with every 3rd, 4th, and 5th grade student. Manila envelopes with study invitation envelopes are in your box. Each envelope contains the Parent Informed Consent Form - Researcher's Copy, Parent Informed Consent Form - Parent's Copy, Recorded Media Addendum to Informed Consent - Researcher's Copy, and Recorded Media Addendum to Informed Consent - Parent's Copy. This envelope will be attached to a letter introducing myself to the parents.
- Please collect signed consent forms/envelopes in the provided manila envelope. All signed consent forms will be due by May 4. I will plan to swing by McCall after school and pick up all signed forms so please turn them in to the front office by 3:15 on Friday.
- Surveys will be conducted only with students who return informed consent documents during the campus' regular computer lab rotation during specials the week of May 9-12. Students who did not return signed consent, refuse to give student assent, or finish the survey early will continue with the lab's regularly scheduled lesson.
- One-on-one interviews will be scheduled to be completed during students' specials rotation time on May 21

The information gathered through this study will help other leaders and educators learn about what motivates their students to participate in the mandatory gamified digital mathematics instructional programs. Such information can be valuable when planning participation

requirements or developing classroom-based incentives related to student participation in the computer program.

I hope you will consider supporting this study with your students as I believe this topic is both valuable to explore and directly applicable to your efforts in the classroom. If you have any questions, please email me at jh89@students.uwf.edu or call at (817) 694-4966.

Thank you,
Jennifer Hoover
Doctoral Student, University of West Florida

Introductory Letter to Parents:

April 30, 2018

Dear parents,

My name is Jennifer Hoover and I am completing my doctorate in Curriculum and Instruction through the University of West Florida. I have served as an elementary school educator and administrator for 11 years and have a passion for making learning relevant to students. I am interested in studying the connection between gamified mathematics programs such as Think Through Math and ReflexMath, both used by students at the school, and student motivation. You are being contacted today in the hopes that you will support this research study and provide informed consent for your child's participation.

Student participation is strictly voluntary and no incentives or penalties will be offered to student participants. The study involves two parts. First, all 3rd, 4th, and 5th grades students with signed parent consent will be invited to participate in a brief survey in the computer lab rotation during specials rotation. The second part of the study will be one-on-one student interviews with students who volunteer to participate.

The attached envelope gives more information about the study and opportunity to provide informed consent. Two copies of the consent documents are provided – one copy to sign and return if you agree to allow your child to participate in the study and one copy to keep for your own records.

If you have any questions, please email me at jh89@students.uwf.edu or call at (817) 694-4966.

Thank you,
Jennifer Hoover, Ed.S.

Participation in this study is strictly voluntary. The choice to participate in part or all of the study is yours and no individual will require your child's involvement. You may withdraw your child from the study at any time by informing the researcher. No incentive or compensation is offered for your child's participation. Any responses provided by your child are confidential and your child's name will not be disclosed by the researcher or published in the finished study.

Scripted Introduction Prior to Electronic Survey:

Hello “Mr./Mrs./Ms. XYZ’s” class!

My name is Mrs. Hoover and I am also in school just like you trying to grow and learn more about learning! Through my program at the University of West Florida, I am trying to learn about the ways that games in computer math programs help motivate students. I am asking you to participate because you are in 3rd, 4th, or 5th grade and already participate in a computer math program at school. If you decide to participate in this study, you will be asked questions in a survey about how the computer math programs you use make you feel. You will be also be asked about your grade, age, if you are a boy or girl, and if you participate in a computer math program at school at least once a week. There is no risk involved by participating in this study and this study will not affect your grade. The survey should take about 20-30 minutes of your time.

You do not have to be in this study if you don’t want to and you can quit the study at any time. If you don’t like a question, you don’t have to answer it and, if you ask, your answers will not be used in the study. No one will get mad at you if you decide you don’t want to participate.

Other than the researchers, no one will know your answers, including your teachers or parents. If you have any questions, just ask me and I am happy to answer them for you.

Your parents have given their permission for you to participate in the study and I am asking if you would like to answer the survey to participate in the study. Here is what we call an “assent document” [pass out Child Assent Form-electronic survey]. It puts into writing what we’ve just talked about. Feel free to read it over, and if you agree to be in the study, you can sign at the bottom. You will have an opportunity to agree again during the survey and you can change your mind at any time.

[Collect any signed Child Assent Forms and answer questions. Students who agree will be provided with the URL leading them to the survey.]

Scripted Closing Statement after Completing Electronic Survey:

Thank you “Mr./Mrs./Ms. XYZ’s” class for your help today. As we finish up our session, I would like to offer you all the opportunity to participate in the second part of my study. In a couple of weeks I will come back NAME OF SCHOOL Elementary and will talk with kids about their participation in computer math programs. These interviews will be in a one-on-one setting. I will ask some questions and will record your responses with an audio recording device that I will then transfer to a typed script.

If you are interested in participating in these interviews, I have a separate form here [indicate where the Child Assent Form–Interview forms are located]. You do not have to participate in the interviews and even if you think you want to participate and then change your mind, you are free to do that. You can change your mind at any time. If you do want to participate in the interviews and your parent has given permission, fill out this form and leave it on your table. I will collect it when you are finished.

[Collect any signed Child Assent Form-Interview forms and answer questions. Students who agree will be verified as not having been a prior student at the researcher’s campus and will be scheduled for an interview.]

Appendix C: Site Approval for the Study

Approval from the hosting campus. Hosting campus is defined by the school district's administrative regulations as the campus that currently employs the researcher.

Date 10/17/17

Dear Mrs. Hoover,

Thank you for completing the application and providing the paperwork for your internship/research request in the area of Gamification within digital mathematics instructional program.

After careful review, your internship/research request is approved for [redacted] (campus name) during the 2017-2018 (semester or school year).

OR

After careful review, your internship/research request is not approved. This is due to _____.

Please remember that:

*Each employee must honor the guidelines established by the Intern/Research Program.
*The internship/research portion of the year may involve duty, conference, or other advisory time and the current workload (teaching assignments) may not be modified to allow for any additional duties that are required by the intern/research program.
*Completion of the internship/research program in a particular area does not in any manner guarantee future employment in that area with [redacted]
*Any school time missed to attend university activities will require the use of a personal day.

Sincerely,

Amy Slade

Campus Principal hosting the internship/research project

Appendix D: Collaborative Institutional Training Initiative Certificates

CITI PROGRAM

Completion Date 05-Mar-2016
Expiration Date 05-Mar-2019
Record ID 18934680

This is to certify that:

Jennifer Hoover

Has completed the following CITI Program course:

Social & Behavioral Research - Basic/Refresher (Curriculum Group)
Social & Behavioral Research - Basic/Refresher (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

University of West Florida

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?wf8c872a5-bf9b-4f2c-a606-d307d8c4bf84-18934680

CITI PROGRAM

Completion Date 01-Mar-2016
Expiration Date 29-Feb-2020
Record ID 18878423

This is to certify that:

Jennifer Hoover

Has completed the following CITI Program course:

CITI Conflicts of Interest (Curriculum Group)
Conflicts of Interest (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

University of West Florida

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?wc793cfaa-1cc2-4bed-94e0-9948b18b32b0-18878423

Appendix E: Institutional Review Board Approval

Conditional Approval Letter. This study received conditional approval on April 23, 2018 from the University of West Florida Institutional Review Board.

University of West Florida

Research and Sponsored Programs
11000 University Parkway, Bldg. 11
Pensacola, FL 32514-5750

April 23, 2018

TO: ***Ms. Jennifer Hoover***

FROM: Dr. Mark Roltsch, Assistant Vice President for Research & Director of RSP

Dr. Ludmila Cosio-Lima, Chair, Institutional Review Board for Human Research Participant Protection

SUBJECT: IRB Full Board Review Approval with Conditions for IRB 2018-175

The Institutional Review Board for Human Research Participants Protection has completed its review of your proposal entitled: "Exploration of self-reported student motivation regarding gamification within digital elementary mathematics programs" as it relates to the protection of human participants used in research, and has granted approval for you to proceed with your study pending the following conditions:

1) Please revise the parental consent form clarity to reflect that the child, not parent, is the participant
2) For the qualitative portion of the study, please exclude students known to the researcher. To accommodate this request given the district policy, please add a co-investigator unknown to the student, or alternatively only use students without a prior relationship to the researcher.
3) Please review the data security requirements below. An electronic version will be sent to you for signature.

•You acknowledge and accept your responsibility for protecting the rights and welfare of human research participants and for complying with all parts of 45 CFR Part 46, the UWF IRB Policy and Procedures, and the decisions of the IRB. You may view these documents on the Office of Research and Sponsored Programs web page at http://research.uwf.edu. You acknowledge completion of the IRB ethical training requirements for researchers as attested in the IRB application.

•You will ensure that legally effective informed consent is obtained and documented. If written consent is required, the consent form must be signed by the subject or the subject's legally authorized representative. A copy is to be given to the person signing the form and a copy kept for your file.

Phone 850.474.2824 Fax 850.474.2082
Web research.uwf.edu

University of West Florida

Research and Sponsored Programs
11000 University Parkway, Bldg. 11
Pensacola, FL 32514-5750

•You will promptly report any proposed changes in previously approved human subject research activities to the Office of Research and Sponsored Programs. The proposed changes will not be initiated without IRB review and approval, except where necessary to eliminate apparent immediate hazards to the participants.

•You are responsible for reporting progress of approved research to Research and Sponsored Programs at the end of the project period December 1, 2018. If the data phase of your project continues beyond the approved end date, you must receive an extension approval from the IRB.
•You will immediately report to the IRB any injuries or other unanticipated problems involving risks to human subjects.

Data Management Agreement for research:

1. I have reviewed the Data Compliance and Restrictions by Service Confluence page, which describes types of storage for electronic data.
2. I agree that all data collection and storage devices must be password protected with a strong password.
3. I agree that sensitive research information on portable devices (USB devices, laptops, cellular phones, tablets, etc.) must be encrypted.
4. I agree that access to identifiable data will be limited to members of the study team.
5. I agree that identifiers, data, and keys should be placed in separate, password protected/encrypted files and each file should be stored in a different secure location.
6. I agree that if it is necessary to use portable devices for initial collection of identifiers, the data files should be encrypted and the identifiers moved to a secure system as soon as possible. The portable device(s) should be locked up in a secure location when it is not in use. The PI should consult with their departmental LSPs to discuss how to correctly configure desktop computers, laptops, and other external devices for safe use in the collection and storage of research data
7. I agree that UWF Google Mail and Calendar services may not be used to collect, store, or transmit sensitive human subjects research data or protected health information (PHI). The Data Compliance and Restrictions by Service Confluence page provides information on what specific IT resources may be used with sensitive human subjects research data and protected health information. If utilizing any cloud-computing services not already defined in the aforementioned page the PI must seek advice from their LSP or ITS.
8. I agree that all data collected on portable devices should be transferred to an approved service as soon as possible after collection, and deleted from the portable collection devices.
9. I agree that if research includes sensitive identifiable data, co-personal investigators, students working on the research (either compensated monetarily or for school

University of West Florida

Research and Sponsored Programs
11000 University Parkway, Bldg. 11
Pensacola, FL 32514-5750

credit), outside consultants or vendors should be required to sign a confidentiality agreement.

10. I agree that if the research design allows, the PI should delete or destroy identifiable information as soon as possible after collection.

Good luck in your research endeavors. If you have any questions or need assistance, please contact the Office of Research and Sponsored Programs at 850-474-2609 or irb@uwf.edu.

Phone 850.474.2824 Fax 850.474.2082
Web research.uwf.edu

Approval Letter. Full approval was granted by the University of West Florida Institutional Review Board on April 23, 2018 upon satisfying the requirements stipulated by the committee.

University of West Florida

Research and Sponsored Programs
11000 University Parkway, Bldg. 11
Pensacola, FL 32514-5750

Ms. Jennifer Hoover

April 23, 2018

Dear Ms. Hoover:

The Institutional Review Board (IRB) for Human Research Participants Protection has completed its review of your proposal number IRB 2018-175 titled, "Exploration of self-reported student motivation regarding gamification within digital elementary mathematics programs," as it relates to the protection of human participants used in research, and granted approval for you to proceed with your study on 04-23-2018. As a research investigator, please be aware of the following:

* You will immediately report to the IRB any injuries or other unanticipated problems involving risks to human participants.
* You acknowledge and accept your responsibility for protecting the rights and welfare of human research participants and for complying with all parts of 45 CFR Part 46, the UWF IRB Policy and Procedures, and the decisions of the IRB. You may view these documents on the Research and Sponsored Programs web page at http://research.uwf.edu. You acknowledge completion of the IRB ethical training requirements for researchers as attested in the IRB application.
* You will ensure that legally effective informed consent is obtained and documented. If written consent is required, the consent form must be signed by the participant or the participant's legally authorized representative. A copy is to be given to the person signing the form and a copy kept for your file.
* You will promptly report any proposed changes in previously approved human participant research activities to Research and Sponsored Programs. The proposed changes will not be initiated without IRB review and approval, except where necessary to eliminate apparent immediate hazards to the participants.
* **You are responsible for reporting progress of approved research to Research and Sponsored Programs at the end of the project period 12-01-2018. If the data phase of your project continues beyond the approved end date, you must receive an extension approval from the IRB.**
* If using electronic communication for your study, you will first obtain approval from the authority listed on the following web page: https://uwf.edu/offices/institutional-communications/resources/broadcast-distribution-standards/.

Good luck in your research endeavors. If you have any questions or need assistance, please contact Research and Sponsored Programs at 850-474-2824 or 850-474-2609 or irb@uwf.edu.

Sincerely,

Dr. Mark Roltsch, Assistant Vice President for Research and Director of the Office of Research and Sponsored Programs

Dr. Ludmila Cosio-Lima, Chair, IRB for Human Research Participant Protection

Appendix F: Consent and Assent Documents

Parental Informed Consent Form – Researcher's Copy – Please Return

Title of Research: Exploration of self-reported student motivation regarding gamification within digital elementary mathematics programs

Researchers: Pat Wentz, Ph.D. and Jennifer Hoover, doctoral student at the University of West Florida

Your child is being asked to participate in research. For you to be able to decide whether you want your child to participate in this project, you should understand what the project is about, as well as the possible risks and benefits in order to make an informed decision. This process is known as informed consent. This form describes the purpose, procedures, possible benefits, and risks. It also explains how your child's personal information will be used and protected. Once you have read this form and your questions about the study are answered, you will be asked to sign it. This will allow your child's participation in this study. You will receive a copy of this document to keep.

Explanation of the Study: Thank you for your interest in this research project being conducted by Jennifer Hoover, an elementary school administrator within the district and a doctoral student at the University of West Florida. Hopefully the introductory letter, enclosed with this consent form, explained the research project. This part of the research project involves two stages. First, I will administer an electronic survey randomly consisting of either the Intrinsic Motivation Inventory (IMI) or the Academic Self-Regulation Questionnaire (SRQ-A) to your child. This will be done in a group setting at your child's school. Your child will then be given the opportunity to volunteer for the second stage of the study involving a one-on-one interview. The major aspects of the study are described in the statements below, including the risks and benefits of having your child participate. I understand that:

(1) My child will be administered the commercially produced *Intrinsic Motivation Inventory (IMI)* or the *Academic Self-Regulation Questionnaire (SRQ-A)* based on my child's random selection during an electronic survey and the length of the survey will be approximately 20 to 30 minutes.

(2) The researcher will share study results with me if I wish, understanding that survey information specific to an individual child will not be available due to the anonymity of the survey. I will indicate my request for a copy of the completed study or a conference with the researcher by checking the appropriate space at the end of this consent form.

(3) My child will be given multiple opportunities to indicate assent to participate in the study and my child may withdraw from the study of their own accord at any time without penalties.

(4) I may discontinue my child's participation in this study at any time without penalties or repercussions and that my child's participation in this study has no impact on my child's grade, academic performance, or educational plan.

Potential Risks of the Study: There are no foreseeable risks involved with the study.

Potential Benefits of the Study:

(1) Data obtained from this study may provide educational professionals information that would allow them to better facilitate learning experiences for study participants.

(2) Information obtained from this study may provide parents with a greater understanding of their child's levels of self-reported motivation to become stronger advocates for their child's educational experiences.

(3) Students may gain a greater respect for their own levels of motivation.

Confidentiality and Records: During survey data collection, no individually identifying information will be collected. Demographic related questions will be limited to age, grade, gender, and participation in a computer math instruction program at school. During the interview portion of the study, your child's name will not be recorded on the transcript. The interviews will be audio recorded and identified by a code indicating grade, gender, and sequence of interviews. At no time will your child's name be referenced in the study results and/or reports.

Compensation: No compensation is offered in exchange for participation in this study.

Contact Information: For any questions, contact Jennifer Hoover through email at jh89@students.uwf.edu or via phone at (817) 694-4966 or Dr. Pat Wentz through email at pwentz@uwf.edu or via phone at (850) 474-2801.

If you have any questions regarding your rights as a research participant, please contact, Institutional Review Board University of West Florida, (850) 474-2824.

By signing below, you are agreeing that:

you have read this consent form (or it has been read to you) and have been given the opportunity to ask questions and have them answered

you have been informed of potential risks and they have been explained to your satisfaction.

you understand University of West Florida has no funds set aside for any injuries you might receive as a result of participating in this study

you are 18 years of age or older

your child's participation in this research is completely voluntary

your child may leave the study at any time. If you decide to stop participating in the study, there will be no penalty to you and you will not lose any benefits to which you are otherwise entitled.

_____ I agree to have my child participate in BOTH the electronic survey and the one-on-one interview

_____ I agree to have my child participate in ONLY the electronic survey

_____ I do NOT agree to have my child participate in this study

I would like a copy of the completed study emailed to me and have included my email address below.

_____YES _____NO

_____ _____
Student's Name (Please Print) Student's Grade

_____ _____
Parent's Signature Date

_____ _____
Parent's Email Address Phone

Parental Informed Consent Form – Parent's Copy – Please Keep

Title of Research: Exploration of self-reported student motivation regarding gamification within digital elementary mathematics programs

Researchers: Pat Wentz, Ph.D. and Jennifer Hoover, doctoral student at the University of West Florida

Your child is being asked to participate in research. For you to be able to decide whether you want your child to participate in this project, you should understand what the project is about, as well as the possible risks and benefits in order to make an informed decision. This process is known as informed consent. This form describes the purpose, procedures, possible benefits, and risks. It also explains how your child's personal information will be used and protected. Once you have read this form and your questions about the study are answered, you will be asked to sign it. This will allow your child's participation in this study. You will receive a copy of this document to keep.

Explanation of the Study: Thank you for your interest in this research project being conducted by Jennifer Hoover, an elementary school administrator within the district and a doctoral student at the University of West Florida. Hopefully the introductory letter, enclosed with this consent form, explained the research project. This part of the research project involves two stages. First, I will administer an electronic survey randomly consisting of either the Intrinsic Motivation Inventory (IMI) or the Academic Self-Regulation Questionnaire (SRQ-A) to your child. This will be done in a group setting at your child's school. Your child will then be given the opportunity to volunteer for the second stage of the study involving a one-on-one interview. The major aspects of the study are described in the statements below, including the risks and benefits of having your child participate. I understand that:

(1) My child will be administered the commercially produced *Intrinsic Motivation Inventory (IMI)* or the *Academic Self-Regulation Questionnaire (SRQ-A)* based on my child's random selection during an electronic survey and the length of the survey will be approximately 20 to 30 minutes.

(2) The researcher will share study results with me if I wish, understanding that survey information specific to an individual child will not be available due to the anonymity of the survey. I will indicate my request for a copy of the completed study or a conference with the researcher by checking the appropriate space at the end of this consent form.

(3) My child will be given multiple opportunities to indicate assent to participate in the study and my child may withdraw from the study of their own accord at any time without penalties.

(4) I may discontinue my child's participation in this study at any time without penalties or repercussions and that my child's participation in this study has no impact on my child's grade, academic performance, or educational plan.

Potential Risks of the Study: There are no foreseeable risks involved with the study.

Potential Benefits of the Study:

(1) Data obtained from this study may provide educational professionals information that would allow them to better facilitate learning experiences for study participants.

(2) Information obtained from this study may provide parents with a greater understanding of their child's levels of self-reported motivation to become stronger advocates for their child's educational experiences.

(3) Students may gain a greater respect for their own levels of motivation.

Confidentiality and Records: During survey data collection, no individually identifying information will be collected. Demographic related questions will be limited to age, grade, gender, and participation in a

computer math instruction program at school. During the interview portion of the study, your child's name will not be recorded on the transcript. The interviews will be audio recorded and identified by a code indicating grade, gender, and sequence of interviews. At no time will your child's name be referenced in the study results and/or reports.

Compensation: No compensation is offered in exchange for participation in this study.

Contact Information: For any questions, contact Jennifer Hoover through email at jh89@students.uwf.edu or via phone at (817) 694-4966 or Dr. Pat Wentz through email at pwentz@uwf.edu or via phone at (850) 474-2801.

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_____ I agree to have my child participate in BOTH the electronic survey and the one-on-one interview

_____ I agree to have my child participate in ONLY the electronic survey

_____ I do NOT agree to have my child participate in this study

I would like a copy of the completed study emailed to me and have included my email address below.

_____YES _____NO

_____ _____

Student's Name (Please Print) Student's Grade

_____ _____

Parent's Signature Date

_____ _____

Parent's Email Address Phone

Recorded Media Addendum to Informed Consent

Researcher's Copy – Please Return

Title of Research: Exploration of self-reported student motivation regarding gamification within digital elementary mathematics programs

Description and Purpose of Recording: The researcher would like to record the audio of each one-on-one interview for the purposes of transcribing verbal language into exact written language.

Confidentiality: Student names will not be recorded on the transcript and transcripts will be coded by grade, gender, and sequence to preserve confidentiality of the child. Audio files will be securely stored in a password-protected folder and then transcribed into typed transcripts. Upon completion of the study, recordings and the master coded list of participants will be permanently deleted while coded transcripts will be retained for a period not less than 2 years.

Voluntary Consent: By signing below, you are granting to the researchers the right to use your child's audio, recorded digitally for preserving, presenting or publishing this research. No use of recorded media will be made other than for the reasons stated herein.

Your participation is voluntary and your refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may discontinue your child's participation in the study and withdraw this consent at any time without penalty.

For any questions, contact Jennifer Hoover through email at jh89@students.uwf.edu or via phone at (817) 694-4966 or Dr. Pat Wentz through email at pwentz@uwf.edu or via phone at (850) 474-2801.

If you have any questions regarding your rights as a research participant, please contact, Institutional Review Board University of West Florida, (850) 474-2824.

Student's Printed Name	Date
Parent / Legal Representative's Printed Name & Signature	Date
Investigator's Printed Name & Signature	Date

Recorded Media Addendum to Informed Consent

Parent's Copy – Please Keep

Title of Research: Exploration of self-reported student motivation regarding gamification within digital elementary mathematics programs

Description and Purpose of Recording: The researcher would like to record the audio of each one-on-one interview for the purposes of transcribing verbal language into exact written language.

Confidentiality: Student names will not be recorded on the transcript and transcripts will be coded by grade, gender, and sequence to preserve confidentiality of the child. Audio files will be securely stored in a password-protected folder and then transcribed into typed transcripts. Upon completion of the study, recordings and the master coded list of participants will be permanently deleted while coded transcripts will be retained for a period not less than 2 years.

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For any questions, contact Jennifer Hoover through email at jh89@students.uwf.edu or via phone at (817) 694-4966 or Dr. Pat Wentz through email at pwentz@uwf.edu or via phone at (850) 474-2801.

If you have any questions regarding your rights as a research participant, please contact, Institutional Review Board University of West Florida, (850) 474-2824.

Student's Printed Name	Date
Parent / Legal Representative's Printed Name & Signature	Date
Investigator's Printed Name & Signature	Date

CHILD ASSENT FORM – electronic survey

Title of Research: Exploration of self-reported student motivation regarding gamification within digital elementary mathematics programs

Researchers from the University of West Florida are trying to learn about the ways that games in computer math programs motivate students. You have been asked to participate because you are in 3rd, 4th, or 5th grade and participate in a computer math program at school. If you decide to participate in this study, you will be asked questions about how the computer math programs you use make you feel. You will be also be asked about your grade, age, boy or girl, and if you participate in a computer math program at school at least once a week. There is no risk involved by participating in this study and this study will not affect your grade. This study will take place at school and should take about 20-30 minutes of your time.

The researchers hope this study will help teachers better understand how to use math games on the computer to motivate students and help them learn better.

You do not have to be in this study if you don't want to and you can quit the study at any time. If you don't like a question, you don't have to answer it and, if you ask, your answers will not be used in the study. No one will get mad at you if you decide you don't want to participate.

Other than the researchers, no one will know your answers, including your teachers or parents. If you have any questions, just ask Jennifer Hoover.

This research study has been explained to me and I agree to be in this study.

_____ _____

Subject's Signature for Assent Date

Check which applies (to be completed by person conducting assent discussion):

_____ the subject is capable of reading and understanding the assent form and has signed above as documentation of assent to take part in this study.

_____ the subject is not capable of reading the assent form, however, the information was explained verbally to the subject who signed above to acknowledge the verbal explanation and his/her assent to take part in this study.

Name of Person Obtaining Assent (Print): _____

_____ _____

Signature of Person Obtaining Assent Date

Electronic survey informed consent

The purpose of this research is to learn about the ways that games in computer math programs motivate students. I am asking 3rd, 4th, and 5th grade students to complete this electronic survey. More specifically, you will be asked to think about how the computer math programs you use make you feel.

The potential benefits of this study are helping us understand how to make computer math games more motivating for you.

There is no risk involved by participating in this study and this study will not affect your grade. It will take about 20-30 minutes to complete the survey.

Your responses will be automatically compiled in a spreadsheet and cannot be linked to you. All data will be stored in a password protected electronic format. The results of the study will be used for scholarly purposes only.

By clicking on the button below you acknowledge that you have read this information and agree to participate in this research. You are free to withdraw your participation at any time and no one will get mad at you if you decide you don't want to participate. If you have any questions, feel free to contact me at jh89@students.uwf.edu.

Agree to participate OR Do not want to participate

CHILD ASSENT FORM – interview

Title of Research: Exploration of self-reported student motivation regarding gamification within digital elementary mathematics programs

Researchers from the University of West Florida Curriculum and Instruction Department are trying to learn about the ways that games in computer math programs motivate students. You have been asked to participate because you are in 3rd, 4th, or 5th grade and participate in a computer math program at school. If you decide to participate in the interview part of this study, you will be asked several open-ended questions about how the computer math programs you use make you feel. All of your information will be kept confidential and your name will not be included on your answer responses. There is no risk involved by participating in this study and this study will not affect your grade. This study will take place at school and should take about 20-30 minutes of your time.

The researchers hope this study will help teachers better understand how to use math games on the computer to motivate students and help them learn better.

You do not have to be in this study if you don't want to and you can quit the study at any time. If you don't like a question, you don't have to answer it and, if you ask, your answers will not be used in the study. No one will get mad at you if you decide you don't want to participate.

Other than the researchers and your parents if they request it, no one will know your answers. If you have any questions, just ask Mrs. Hoover.

This research study has been explained to me and I agree to participate in this study.

_____ _____ _____

Student's Name Teacher's Name Grade

_____ _____

Subject's Signature for Assent Date

Check which applies (to be completed by person conducting assent discussion):

_____ the subject is capable of reading and understanding the assent form and has signed above as documentation of assent to take part in this study.

_____ the subject is not capable of reading the assent form, however, the information was explained verbally to the subject who signed above to acknowledge the verbal explanation and his/her assent to take part in this study.

Name of Person Obtaining Assent (Print):_____

_____ _____

Signature of Person Obtaining Assent Date

Appendix G: Instruments Used in the Study

Electronic survey Administered through Google Forms.

"How do you feel about computer math games?"

Electronic Survey Informed Consent

The purpose of this research is to learn about the ways that games in computer math programs motivate students. I am asking 3rd, 4th, and 5th grade students complete this electronic survey. More specifically, you will be asked to think about how the computer math programs you use make you feel. The potential benefits of this study are helping us understand how to make computer math games more motivating for you. There is no risk involved by participating in this study and this study will not affect your grade. It will take about 20-30 minutes to complete the survey. Your responses will be automatically compiled in a spreadsheet and cannot be linked to you. All data will be stored in a password protected electronic format. The results of the study will be used for scholarly purposes only. By clicking on the button below you acknowledge that you have read this information and agree to participate in this research. You are free to withdraw your participation at any time and no one will get mad at you if you decide you don't want to participate. If you have any questions, feel free to contact me at jh89@students.uwf.edu.

Agree to participate OR Do not want to participate

Demographic Information

Are you a…

BOY OR GIRL

How old are you?

8 9 10 11 12

Please select your grade:

3rd grade 4th grade 5th grade

Do you participate in a computer math program at school at least once a week?

YES OR NO

Closing Screen

Thank you for your participation in this survey. If you would like to participate in the interview part of the study, please close this screen and request a copy of the Child Assent Form-interview. Interviews will be scheduled with your teacher in the next couple of weeks.

Interview questions:

Interview questions will be semi-scripted based off the trends preliminarily identified from the survey results. Such questions may include:

- This research study is focused on gamification in math computer programs. What do you think "gamification" means?
- For this study, gamification is where an activity that is not a game has parts that act like a game to make the activity more interesting. Thinking about [insert name of gamified digital mathematics instructional program adopted by the campus], what parts of the program do you think are a part of gamification?
- Thinking about [using the elements the student identifies above], why do you think that is gamification?
- How do you think [example(s) given by the student] helps you learn?
- How do you think [example(s) given by the student] motivates you to work in the program more?
- How do you think [example(s) given by the student] motivate you to try to do more of the program?
- In what ways do you think [example(s) given by the student] motivate you to learn more about math?
- How do the [gamified elements featured in the gamified digital mathematics instructional program adopted by the campus i.e., reward levels/avatars/points/leaderboards] make you feel?
- How do you feel when you do well with the [gamified elements featured in the gamified digital mathematics instructional program adopted by the campus i.e., reward levels/ avatars/ points/ leaderboards]?
- How do you feel when you don't do well with the [gamified elements featured in the gamified digital mathematics instructional program adopted by the campus i.e., reward levels/avatars/points/leaderboards]?
- What would you change about [example(s) given by the student] to make you more interested in doing the program?