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The Effects of a Gamified Curriculum on High-School Students

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Dedication

To my remarkable wife, Kimberly,

Who inspires me every day

And puts up with my continual shenanigans.

And to my rambunctious rug rats, Zoë, Jacob, and Maggie.

Daddy doesn't have to work on a paper anymore.

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Abstract

One of the emerging trends in education is gamification, a concept that has been applied in other fields, such as business and advertising, with great success. Gamification can be defined as adding game elements to non-game constructs. This study followed a high-school Algebra II teacher and 10 of her students in an attempt to document the effects of gamification on student academic engagement. Multiple methods of data collection were used to gather data from students and teachers. After analysis, the data showed that gamification had a positive effect on student academic engagement. The results were used to create an action plan that focuses on ways to incorporate game dynamics into the classroom in order to increase student academic engagement.

Keywords: action research, gamification, academic engagement, game dynamics, high-school

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CHAPTER ONE: Introduction

Introduction

The video game industry has been one of the fastest growing industries over the past few decades. In fact, studies show that teenagers are spending more and more time playing video games (Entertainment Software Association, 2014, 2017). While some people may have the perception that engaging in video games as a waste of time, the Entertainment Software Association (2017) reports that 71% of parents believe that "video games have a positive influence on their child's life" (p. 10), up from 56% in 2014 (Entertainment Software Association, 2014), citing benefits such as mental stimulation, education, connecting with friends, and spending time playing together as a family.

And video games have grown beyond the individual level, with the growth of eSports video entertainment. eSports generally take the form of organized competitions between video-game players, often on a professional or collegiate level. As of this writing, there are over 50 colleges in the United States that have varsity gaming teams, complete with coaches, analysts, and player scholarships (CBS, 2017). This goes hand in hand with the enormous audiences watching professional eSports tournaments, such as the Intel Extreme Masters World Championship 2017, which had 46 million unique viewers (Elder, 2017).

These statistics paint a picture of a phenomenon that holds great potential for educators. Many teenagers choose to spend a large percentage of their time playing or

watching others play video games, demonstrating that video games are extremely engaging. Interestingly, not all video games are engaging, so it is not necessarily the format itself that provides the engagement, but rather the elements that make up the game itself. With that said, the video game industry has provided an extremely useful library of games, created by professionals specializing in maximizing engagement. It follows that educators could adopt many of the conventions of video games in order to increase student academic engagement in school.

One of the most important factors for a student's academic success is that they must remain academically engaged in their learning (Christenson, Reschly, & Wylie, 2012). Abbott (2014) defines academic engagement as "the degree of attention, curiosity, interest, optimism, and passion that students show when they are learning or being taught, which extends to the level of motivation they have to learn and progress in their education" (para. 1). Because of its importance, academic engagement has been the subject of a great deal of research, and it has been determined to be one of the leading factors in student academic achievement, dropout rate, burnout, and well-being (Conner & Pope, 2013; Gerber, Mans-Kemp, & Schlechter, 2013; Landis & Reschly, 2013; Tuominen-Soini & Salmela-Aro, 2014; Upadyaya & Salmela-Aro, 2013; Weiss & García, 2015).

One aspect of academic engagement that educators have recently began to study is the effects of using educational video games in the classroom, with varying results in regards to their efficacy (Blumberg, Altschuler, Almonte, & Mileaf, 2013; Drugas, 2014; Wilson, Majsterek, & Simmons, 1996). The idea is that, because video games are engaging, educators can tap into this engagement to increase student academic

engagement. However, this has been largely unsuccessful, mostly due to the fact that educational video games are not, in and of themselves, engaging. Simply digitizing a worksheet and having an animated robot give the instructions is not significantly more engaging than traditional instruction. It is the internal "game dynamics" that make successful games engaging.

Statement of the Problem of Practice (PoP)

When presented with a traditional instructional approach based on worksheet and textbook, high-school students are often motivationally deflated (Devlin, Feldhaus, & Bentrem, 2013). Based on the researcher's observations and interactions with students in classes that use traditional teaching methodologies, it is plain that many have lost motivation for completing their schoolwork. Many students exhibit signs of academic disengagement, such as not completing schoolwork, not participating in class discussions, falling asleep in class, talking about class topics with derision, etc. These signs, among others, demonstrate a struggle to maintain academic engagement in these students. The researcher also noticed that many of these same students spend much of their free time playing video games, remaining engaged in the activity of gaming for extended periods of time.

Therefore, the identified problem of practice for this study involves the use of gamification with eleventh-grade students in order to examine the impact on student motivation. Following Deterding, Dixon, Khaled, and Nacke (2011), gamification as a pedagogy in the present study is defined as the use of "game design elements in non-game contexts" (p. 9). Gamification will replace the current instructional approach in one rural South Carolina Algebra II classroom, which has traditionally used the instructional

techniques of teacher lecture, teacher questioning, and student work sheets. This classroom is led by a teacher-participant who agreed to allow the researcher to observe her class and students.

The school in question is in an extremely low-SES area, where the median household income is $35,494 and 25% of the population classified as living in poverty. Only 16% of the population has obtained an undergraduate degree of higher, and the unemployment rate is 5.9%. The median home value in this area is $73,210, and 42.7% of residents rent their home (Sources redacted to ensure participant confidentiality).

To clarify, because the researcher is a former classroom teacher, but currently a district-level instructional coach, the researcher will observe an Algebra II class, in which a teacher-participant will continue the majority of her instructional practices while modifying some very specific aspects of her practice, as described later in this paper. She will still use teacher lecture and questioning, though some planned assignments will be replaced by others that facilitate student choice (a major facet of gamification).

In addition to the researcher's observations mentioned above, the teacher of this class has expressed concerns with her students' levels of academic engagement, evidenced by students falling asleep in class, not turning in work, and not participating in class discussions or activities. In addition, student academic achievement is lower than expected, and one probable cause is due to low academic engagement, because of the positive relationship that exists between academic engagement and academic achievement (Chen, 2014; Meschke, Peter, & Bartholomae, 2012; Petscher, 2010).

Research Question

What impact will a gamification model of instruction have on the engagement level of 10 11th-grade students in a high-school Algebra II class?

Purpose of the Study

The purpose of this study is to examine the impact of a gamification model of instruction on the engagement level of 11th-grade students in a high-school Algebra II class.

In order to better understand the definition of a gamification model of instruction, see the definition of terms. Building on the work of Abbott (2014), and for the purposes of this study, engagement will be defined as the extent of interest, curiosity, interest, and passion shown by students while learning.

The following observable phenomena serve as indicators of students who appear to be academically engaged:

- The student contributes to class discussions.
- The student participates in class activities.
- The student completes required classwork and homework.
- The student asks pertinent questions that further the discussion of class subject matter.

Methodology

The participants in this study will include 10 11th-grade students currently enrolled in an Algebra II class. Student academic engagement will be measured using a single-group pretest-posttest observational study design: student academic engagement

will be measured before the introduction of the gamification instructional approach model, after the introduction of the model, and after completion of the gamified unit.

Multiple methods of data collection will be used, both with students and with teachers. Data will be collected through the use of pre/post attitudinal Likert scale survey, semi-structured interviews, observations and the taking of field notes, and the collection of artifacts.

Game Dynamics Curriculum Model

The Game Dynamics curriculum model is a method of curriculum construction based on Hunicke, LeBlanc, & Zubek's (2004) MDA framework of game design. The three elements of this framework are Mechanics, Dynamics, and Aesthetics. Mechanics are the "rules" of the game; each individual component at the most basic level, such as algorithms. Aesthetics are the emotional responses experienced by the players of the game when they play the game. Dynamics is the interaction between the two, during which player inputs influence the mechanics, which, in turn, influence the aesthetics.

The Game Dynamics curriculum model focuses on creating a curriculum that incorporates these elements, focusing on achieving engaging game dynamics. The three dynamics that this paper will concentrate on are "Incremental Progression," "Multiple Routes," and "Psychosocial Moratorium."

Incremental Progression. The *Incremental Progression* game dynamic can be defined as *the idea that people perform better if they are able to experience continual progression, no matter how small, towards a goal.* This dynamic is present in most Role Playing Games, such as *Dungeons & Dragons* (Heinsoo, Collins, & Wyatt, 2008), in the form of Experience (XP). Players gain XP by defeating enemies and completing quests –

as their XP increases, they become more powerful. This is present in the academic world in the form of a total-points grading system in which students begin with 0 and gain points by completing assignments, up to the maximum (this is the system used in many college classes).

Multiple Routes. The *Multiple Routes* game dynamic can be defined as *a system in which participants have multiple options in how to progress towards a final goal.* James Paul Gee (2007) suggests that this system benefits learners because "[t]here are multiple ways to make progress or move ahead. This allows learners to make choices, rely on their own strengths and styles of learning and problem solving, while also exploring alternatives" (p. 223). This dynamic is present in the game *League of Legends* (Riot Games, Inc., 2009) in which players can choose which role to play, which champion to play, the order in which they get new abilities, and a myriad of other choices. This dynamic is present in the academic world when students choose their elective classes or when a teacher allows students to choose from multiple possible assessment formats.

Psychosocial Moratorium. The *Psychosocial Moratorium* (Gee, 2007) game dynamic can be defined as *a system in which the real-world consequences for failure are reduced, allowing participants the ability to "fail forward" and learn from their mistakes without worrying about the real-world consequences.* This is present in the video game *Super Mario Bros.* (Nintendo, 1985) in that players who fail are immediately allowed to try again, thus encouraging learning through trial and error. This is present in the academic world in mastery-based grading systems, in which students are allowed to retake summative assessments until mastery is achieved.

Significance of the Study

In order to best serve their students, teachers must continually adapt to meet their needs. This study will investigate the efficacy of a gamified instructional model on student academic engagement. If it proves to have a positive impact, not only will it help the participating students by increasing their academic engagement, it will also encourage additional research in order to further explore this relatively unknown method of curriculum design.

Limitations of the Study

There are three limitations in this study. First, the participants were a convenience sample rather than a random sample, though this is to be expected with action research (Mertler, 2014). Moreover, the sample size was also very small, at just 10 students and one teacher. An additional limitation is the fact that the researcher is admittedly biased about the subject matter, possessing a belief that a gamified instructional model is effective at increasing student academic engagement. In order to overcome this limitation, the researcher strove to remain objective throughout the process, as well as using triangulated data to support each conclusion.

Dissertation Overview

The following chapters include a comprehensive review of the literature, a description of the methodology used in the research study, an analysis of the findings, and a summary of the researcher's conclusions. There are also several appendices that include the data-collection instruments.

Definition of Terms

Academic Engagement: The amount of interest a student shows in academic work, evidenced by attention, curiosity, motivation, and passion (Abbott, 2014).

Aesthetics*:* Part of the MDA Framework for game design, the Aesthetics of a game are the emotional responses experienced by those who play it. They are the result of the Mechanics translated through the Dynamics

Engagement: The extent of interest, curiosity, interest, and passion shown by students while learning.

Game Dynamic: An aspect of games that is designed to facilitate player involvement, and which results from an interaction between the game's mechanics and the players' reactions (Hunicke et al., 2004).

Gamification: Adding elements of games to something that is not a game, usually with the goal of increasing engagement (Deterding et al., 2011).

Gamified Curriculum*:* A curriculum that incorporates one or more elements of game design, usually in an attempt to increase academic engagement or outcomes.

Incremental Progression: The idea that people perform better if they are able to experience continual progression, no matter how small, towards a goal.

Mechanics*:* Part of the MDA Framework for game design, the Mechanics are the rules of a game as defined by the game designers, such as data representation, algorithms, or mathematical formulas.

Multiple Routes: A system in which participants have multiple options in how to progress towards a final goal.

Psychosocial Moratorium: A system in which the real-world consequences for failure are reduced, allowing participants the ability to "fail forward" and learn from their mistakes without worrying about the real-world consequences (Gee, 2007).

CHAPTER TWO: Review of Literature

In its most basic form, gamification is simply the application of game principals in non-game contexts. In the context of education, gamification is using game principals, such as competition or narrative, in classroom practice. Many teachers have been doing this for years, such as having class competitions for who can get the most multiplication problems correct. However, only recently have researchers begun collecting data on the concept as a whole, rather than focusing on its disparate elements.

The concept of gamification, though still in its infancy in the context of education, has been around for over a century in the business world. One of the early examples is the use of S&H Green Stamps to inspire customer loyalty (Hatala, 2013). Customers would be given stamps for purchasing various goods or services, which they would collect in stamp books and redeem for various products, such as bicycles, appliances, towels, and many others. This was extremely successful at inspiring customer loyalty, especially during the 1960s, though recessions and inflation in the 1970s caused substantial declines in their popularity (Cellania, 2015).

This concept has expanded and is now pervasive throughout the business world, with such examples as credit card loyalty points, frequent flyer miles, and grocery story loyalty cards. All of these are an attempt to use operant conditioning (Skinner, 1991) in order to increase customer loyalty and engagement by providing extrinsic rewards (Sharp & Sharp, 1997).

Though its initial application was almost entirely in the context of business and economics, gamification has since expanded into various other areas. One example is how it has been incorporated into various online communities such as Reddit.com and StackExchange.com. Users of these sites post comments and/or reply to the posts of others, which are then voted on by the other community members. Posts with a high ratio of positive votes enjoy increased visibility, and the users who post them earn points for each vote. This has the benefit of encouraging users to post high-quality content and comments, increasing the experience for all users (Thongtanunam et al., 2013).

As the application of gamification grew in other contexts, educators began to wonder if it could be used to increase student learning outcomes. However, this only extended to the use of "educational videogames" in the classroom, rather than actually applying the tenets of gamification to the educational process. An early example of an educational videogame is the *Carmen Sandiego* series of educational computer games (*Where in the World is Carmen Sandiego?*, 1985). Though these games were not designed as educational tools, they were adopted by teachers to help teach research skills and geography in a way that was "entertaining enough to disguise the fact that you might be learning something while you play" (McCullough, 1986, p. 47).

It is only in recent years that educators have started to use gamification to inform curriculum and course design, rather than simply trying to incorporate educational videogames into the curriculum. One example of this is the Quest to Learn school, which is a public charter school in New York City that incorporates game-based learning into classroom practice and curriculum design (“About Q2L,” 2017). Quest to Learn has demonstrated impressive results, with an average attendance rate of 94%, and 54% of

their students scoring proficient on the state ELA exam, compared to the citywide average of 30% ("About Q2L," 2017). While it is not possible to claim that gamification is solely responsible for these outcomes, it is reasonable to assume it is a contributing factor.

The concept of gamification continues to grow in the educational realm, evidenced by a drastic increase in professional development offerings focusing on gamification. For example, there were 184 sessions on gamification at the International Society for Technology in Education (ISTE) 2017 conference, increasing from 22 in 2016 ("Program Guide," 2016; "Program Guide," 2017). With this exponential growth in popularity, however, came many interpretations of what gamification is and is not, which led to a great deal of misunderstanding and misinformation of the topic (Boulet, 2012).

The MDA Framework

The Mechanics-Dynamics-Aesthetics (MDA) Framework was originally developed by Hunicke, LeBlanc, & Zubek (2004) and quickly became a foundational framework in the game-design industry. While the intended audience for Hunicke, LeBlanc, and Zubek's paper was only the game-design community, it is applicable in a much broader context, including education and business.

In its most basic form, the MDA Framework is a conceptual model that describes the two-way relationship between game designers and game players when interacting through a game. Each of the three components of this framework are defined as follows:

Mechanics describes the particular components of the game, at the level of data representation and algorithms.

Dynamics describes the run-time behavior of the mechanics acting on player inputs and each others' outputs over time.

Aesthetics describes the desirable emotional responses evoked in the player, when she interacts with the game system. (p. 2)

To explain further, *mechanics* are the "nuts and bolts" of a game. This could be as simple as the rule that a pawn can move forward two squares on its first turn or as complex as the millions of mathematical operations running during a video game boss fight. The important thing to remember is that this is the only part of this framework that is directly controlled by the game designer, and it is the initial foundation upon which the other two aspects are constructed.

The *aesthetics* of a game are the emotional responses experienced by those who play it. It is important to be specific in describing the *aesthetics*, and avoid verbiage such as "fun" in favor of more specific terms such as "fantasy," "narrative," or "fellowship" (Hunicke et al., 2004, p. 2). This allows the game designer to create specific emotional reactions in order to engage players more effectively.

For example, the game Charades evokes several *aesthetics* in most players: challenge, expression, fellowship, and discovery. By focusing on each specific *aesthetic*, game designers are able to fine-tune their games to evoke the emotional responses of their players more effectively.

Both *mechanics* and *aesthetics* are relatively simple concepts, but *dynamics* are much more complex. First of all, *dynamics* are in the middle between *mechanics* and *aesthetics*, and are not directly controllable by any party. *Dynamics* serve to take the *mechanics* and translate them into *aesthetics* while also accepting player inputs and

applying them to the *mechanics*. Hunicke et al. (2004) give an example of this relationship:

> Dynamics work to create aesthetic experiences. For example, *challenge* is created by things like time pressure and opponent play. *Fellowship* can be encouraged by sharing information across certain members of a session (a team) or supplying winning conditions that are more difficult to achieve alone (such as capturing an enemy base). (p. 2).

This framework applies to the construction of *any* curriculum, especially one that incorporates gamification, by establishing that the authors of the curriculum must consider how the elements of the curriculum will evoke *aesthetics* with the students, and how student responses will create *dynamics*.

For example, many middle schools have a rule that no student will receive less than a 60% on any assignment, even if nothing is submitted. This represents the *mechanic*, as it is the "rule." The *aesthetic* created in many students is apathy, as they reach the conclusion that they can do literally no schoolwork for half the year and still pass. This creates the *dynamic* of students doing just that, which (sometimes) influences the administration to alter the rule, such as making 60% the minimum if work is submitted. This in turn changes the *dynamic* so that students turn in blank handouts in order to continue to get a 60% while doing the minimal amount of work.

It is easy to see that the *mechanics* should be alterable at any time in order to maintain desired *dynamics* and *aesthetics*. Therefore, when constructing a curriculum, the authors should make sure to retain the ability to make changes as needed.

Game Dynamics

There is currently a great deal of debate in the game-design industry over what a "game dynamic" actually is. However, for the purposes of this study it will be defined as an aspect of games that is designed to facilitate player involvement, and which results from an interaction between the game's mechanics and the players' reactions. In their landmark paper describing the MDA Framework (Mechanics, Dynamics, and Aesthetics) for game design, Hunicke et al. (2004) described game dynamics as the "middlemen" that act as the arbiters between the "Mechanics" of the game, which are created by the game designer (data representation, algorithms, mathematical formulas, etc.) and the "Aesthetics," which are experienced by players of the game (the emotional responses of players to the games). The only part of this continuum that game designers can change are the "Mechanics," which go on to influence the other sections. However, game designers need to remain cognizant of the "Dynamics" and the "Aesthetics," as those are the sections with which players of the game are primarily concerned (Hunicke et al., 2004; Poole, 2004). Therefore, game designers must remain vigilant and consider how their "Mechanics" will evolve into "Dynamics," which will help set the "Aesthetics."

Players of games also influence the "Dynamics" by the way that they play the game (Hunicke et al., 2004). To give an example, the game of chess has had very few rule changes for hundreds of years. However, the game has continued to evolve as a "meta game" emerges, characterized by the popularization of certain strategies, which causes the players to react with counters to these strategies, thus changing the "meta game" again. This process is very fluid and difficult to quantify, but it has been present in nearly every competitive game throughout history (Pell, 1993). Therefore, it is very

important for anyone wanting to implement game dynamics to consider the players of the game who, in the context of this research project, are the student-participants.

Prior Research

While the subject of a gamified curriculum for high-school students is relatively new, there has been some research conducted on related subjects, such as the effects of using video games as instructional tools or the use of gamification techniques in the business world.

One such study was conducted by Simões, Redondo, and Vilas (2013) in order to define a theoretical framework for the social gamification of K-6 classes. The researchers identified social gaming as one of the most popular forms of gaming and integrated a social gaming platform into a preexisting software platform.

When designing these changes, Simões et al. (2013) focused on several guidelines, such as:

> Allow repeated experimentation - learning activities, like games, should allow repeated experimentation in order to reach a goal.
>
> Include rapid feedback cycles - immediate feedback helps students improve their strategy and get a better chance of success in the next try. (p. 348)

These guidelines are examples of the "Psychosocial Moratorium" game dynamic because students are encouraged to learn through experimentation by having low consequences for failure instead of the traditional method, which punishes students for failure, such as assigning a low grade.

In addition, Simões et al. (2013) incorporate the "Multiple Routes" game dynamic, which allows for multiple ways to progress towards a goal. They write: "Allow

different routes to success - each student should be able to choose a different sequence of sub-tasks, following hers/his [sic] own route to complete the task" (p. 348). It is important to note that this is a lesser form of the "Multiple Routes" game dynamic because it still requires all students to complete the same tasks. A more effective application would be to give students choice between a few possible assignments that assess the same skill or knowledge, allowing students to play to their strengths and passions rather than forcing them into a single assessment methodology.

Another research study was conducted by Best (2013) that involved the use of "exergames" (a portmanteau of "exercise" and "video games") in an attempt to increase physical activity in teens. The study found that the use of "exergames" was effective in increasing physical activity, as well as cognitive functions, though it does suggest that further research be conducted on the subject.

The efficacy of gamification has also been studied in the realm of business, such as a study conducted by Constantin & Stoenescu (2015) which attempted to discern the impact of gamification on the recruitment of potential employees. This research study found that applicants had a positive reaction to the gamified elements of the recruitment process, "considering them useful and engaging" (p. 55).

While these studies have been promising, some studies have suggested that gamification is not a significant factor for increasing academic outcomes. One study was conducted by Marcus Leaning (2015) that involved incorporating gamification elements into undergraduate media-studies classes. The results of this study showed a 2.14% increase in the mean grade on a summative assessment for the experimental group in comparison to the control group, which was not statistically significant. This is

tangentially related to this research project because academic engagement is positively correlated with academic outcomes (Conner & Pope, 2013; Gerber et al., 2013).

Academic Engagement

If one is to conduct a study on academic engagement, it is vital to have a clear definition of what engagement is. According to Abbott (2014), academic engagement is "the degree of attention, curiosity, interest, optimism, and passion that students show when they are learning or being taught, which extends to the level of motivation they have to learn and progress in their education" (para. 1). This definition is clear, but lacks specificity in how it is to be measured, as it is impossible to objectively determine curiosity, interest, etc. Therefore, this definition will serve as the foundation of the discussion, but it is necessary to identify indicators of academic engagement if meaningful research is to be conducted.

One of the most likely reasons that academic engagement is so closely correlated with academic achievement is due to the way that memory works. Jeanne Ormrod (2014) describes how information reaches the long-term memory as a three-step process, according to Information Processing Theory, which is a cognitive approach to understanding the way that the brain processes information. First, the information enters the Sensory Register, which means it registers with the physical senses. However, the only way for information to move past the Sensory Register is for the subject to pay attention to it. This means that the vast majority of all information that enters the Sensory Register is lost. If the subject pays attention to the information, it moves to the Working Memory, where it stays as long as the attention is sustained. Some of the information in the Working Memory is passed along to the Long-Term Memory, but some is lost. The

longer information remains in the Working Memory, and the more importance the subject attaches to it, the more likely it is to be stored in the Long-Term Memory.

Therefore, if students are to retain the concepts, skills, and facts teachers want them to learn, they need to pay attention to them. In order for this to happen, they need to be engaged with their learning. This means that teachers need to help their students create and maintain academic engagement in order to help them retain what they learn.

Interaction

In order for most students to learn and understand the subject of their study, they must interact with it, not passively receive a lecture or study notes. The "drill and kill" method of instruction is extremely disengaging, and does not produce academic achievement (Taylor & Parsons, 2011). One increasingly popular way to create interactivity in the classroom is through the use of multimedia, such as interactive websites. Many researchers have differentiated between interactivity and multimedia in their findings, but others hold that multimedia is engaging not simply because it is multimedia, but *because it is interactive* (Blumberg et al., 2013; Coyne, Padilla-Walker, Stockdale, & Day, 2011; Gee, 2012). Humans are naturally social creatures, and most learn best when they are interacting not only with the subject of their learning, but with other learners (Claxton, 2007; Dewey, 1916, 2013; Gee, 2007; McGonigal, 2008).

The importance of learner interaction has been established through a large body of research, including the work of Jang, Vitale, Jyung, and Black (2017) who determined that medical students who interact with complex biological structures are much more likely to be academically engaged, as well as demonstrate a better understanding of the structures, compared to students who passively viewed a video recording of the

structures. They conclude that direct manipulation of these complex structures helped students gain a more thorough understanding of them as compared to passive viewing.

Other work by Riley and Ward (2017) demonstrates a similar phenomenon in the context of accounting information systems. Three groups of students completed an assignment under three different learning conditions: individual active learning, cooperative active learning, and passive lecture. They found that the two active learning groups were significantly more interested in the assignment content than the passive lecture group. They concluded that active learning tends to enhance student satisfaction and learning outcomes.

Overall, it has been demonstrated that students are more likely to be academically engaged with the content if they are able to interact meaningfully with it.

Curiosity and Exploration

Human beings are naturally curious, so many of the classroom practices that engage students are inquiry-based and exploratory, such as Problem Based Learning (PBL) or the Montessori method of education (Oblinger & Oblinger, 2006; Willms, Friesen, & Milton, 2009; Windham, 2005). It follows that when students are given the opportunity to pursue their own interests, rather than a teacher-prescribed subject of study, they usually demonstrate more academic engagement.

According to Dyche and Epstein (2011), "curiosity tends to flourish in educational environments that promote the student's responsibility for his or her own learning, multiple perspectives and mindful reflection on both the subject and the learning process" (p. 663). They continue to state that curiosity is a vital drive for education if students are to be successful, and that curiosity and exploration flourish

when students take responsibility for constructing their own learning. One of the identified effects when curiosity is suppressed in an educational environment is the relegation of the learner to a passive role rather than active engagement.

Another study that linked exploration to increased academic engagement found that students who demonstrated high levels of curiosity when reading were more engaged in reading, and achieved higher reading achievement than those who demonstrated low levels of curiosity (Gurning & Siregar, 2017). The study found that "the students with high curiosity will have great desire to [question] the gaps in the learning, seek exploratory information and knowledge, answer particular questions and [demonstrate] good attention in learning…" (Gurning & Siregar, 2017, p. 197). The inverse was true of students with low curiosity, who were less likely to even attempt any challenging reading.

In summary, curiosity and the resulting exploration have been shown to increase student academic engagement.

Relevance

The best example of relevance in today's classroom is through the use of authentic assessments. Another reason PBL is so engaging to students is due to the fact that it is very authentic, because it places the students in the middle of real-life situations and asks them to assume a real-life role. This creates a sense of purpose in students, making their learning "real" rather than the theoretical learning many are used to (Claxton, 2007; Willms et al., 2009).

Authentic assessments have long been established as being more engaging for students. One example can be found in Howard Sacks' work, which states, "If an

experience seems real, the beneficial effects on students are likely to be several. Students have more interest in the subject matter, and are better motivated to learn. They work harder, and pay closer attention to what is happening" (as cited in Hart, Hammer, Collins, & Chardon, 2011, p. 99). Many of these benefits (such as interest, motivation, and hard work) are indicators of increased academic engagement.

Another example of authentic assessments increasing academic engagement was Kearney's (2013) discussion of rampant academic disengagement in higher education when students are required to complete "traditional forms of assessment" (p. 875) such as multiple-choice tests. The author found that students were much more likely to demonstrate academic engagement when the assessment was authentic and reflected real-world situations.

Underlying Causes of Academic Disengagement

There are many underlying causes that influence a lack of academic engagement in high-school students. One cause is a lack of a sense of relatability in students (Furrer & Skinner, 2003). By definition, high-school teachers are well educated, as the position requires a minimum of a bachelor's degree. In addition, teachers in working-class areas often earn significantly more income than the parents of the students they teach. The issue of relatability is even worse for working-class poor, rural, southern students, because a significant portion of the student population is often composed of minorities while the teachers are still predominantly White (Deruy, 2013). All of these factors present barriers to student relatability, making it more difficult for students to engage when their teachers are so different from them.

Another negative factor influencing student engagement is the lack of agency experienced by many of these students (Aydin, 2016; Portnow, 2013; Walker, Greene, & Mansell, 2006). When students feel as they have little to no control over an aspect of their lives, they are much less likely to engage with it in any meaningful way. Many students see their academic lives in this manner: they get similar grades whether they try or not, so they disengage academically (Aydin, 2016; Walker et al., 2006).

A possible negative factor influencing student engagement would affect students who find themselves in classrooms in which teachers do not incorporate technology into their instructional approach. Research has shown that technology integration is often very engaging for high-school students (Blumberg et al., 2013; Blumberg & Fisch, 2013; Coyne et al., 2011; Gonzalez, 2014). Therefore, students who are in a classroom without technology embedded into the instruction are more likely to disengage because of the lack of technology integration.

There are many other reasons that students may choose to disengage academically. One such reason is the fact that many students find the "banking" model of education to be fundamentally disengaging (Freire, 1970; Ivey & Johnston, 2013). According to Freire (1970), the banking model of education is one in which students are seen as containers that teachers fill up with knowledge, and is reflected in much of the traditional educational system, in which teachers are seen as the expert holders of knowledge, while students are ignorant vessels in need of the knowledge that can only be obtained from the teachers. “In the banking concept of education, knowledge is a gift bestowed by those who consider themselves knowledgeable upon those whom they consider to know nothing” (Freire, 1970, p. 72). This mindset is reflected in traditional

teacher-centered instructional strategies, in which the teacher lectures and students take notes and complete independent work. Freire discusses an alternative to the banking model in the "problem-posing" model of education, which emphasized collaboration and critical-thinking. Freire clarifies, "The role of the problem-posing educator is to create; together with the students, the conditions under which knowledge at the [popular opinion] is superseded by true knowledge" (1970, p. 81).

Another reason is that the standardization of education has had very disengaging effects on students because it does not allow for personal preference and passion (Chen, 2014; Gee & Levine, 2008; Ivey & Johnston, 2013). Finally, many students disengage simply because they would rather be doing another activity, such as socializing (Merga, 2014).

Theoretical Base

Whenever one is constructing a curriculum, it is vital to begin on a firm theoretical foundation, considering the educational research and theory that has come before in order to learn from the past. For this project, two educational ideologies are especially important: Learner Centered Ideology and Social Reconstruction Ideology.

Learner Centered Ideology

According to Schiro (2013), "Learner Centered Ideology" is concerned with creating a learning environment that considers the strengths, weaknesses, passions, and other individual aspects of each of the students. Those who hold to this belief claim that students will learn best when the curriculum is tailored to each student individually. This ideology is diametrically opposed to the Scholar Academic Ideology, which, according to E. D. Hirsch (as cited in Schiro, 2013) focuses on instilling within students "the basic

information needed to thrive in the modern world" (p. 15). In other words, those who follow the tenets of the Scholar Academic Ideology believe that education should be primarily focused on teaching facts, figures, dates, and formulas. However, those who hold to a Learner Centered ideology believe that teachers should be facilitators of learning who help students construct their own learning by enabling them to pursue their passions (Schiro, 2013). This requires educators to gain a deep knowledge of their students in order to help them learn on an individual basis.

Educational theorist John Dewey (2013) discusses the fact that formal education is "primarily a social institution" (p. 35) and that, in order to educate students properly, the curriculum needs to be differentiated:

> Only through the continual and sympathetic observation of childhood's interests can the adult enter into the child's life and see what it is ready for, and upon what material it could work most readily and fruitfully.
>
> These interests are neither to be humored nor repressed. To repress interest is to substitute the adult for the child, and so to weaken intellectual curiosity and alertness, to suppress initiative, and to deaden interest. To humor the interests is to substitute the transient for the permanent...To humor the interest is to fail to penetrate below the surface, and its sure result is to substitute caprice and whim for genuine interest. (p. 37)

In order to apply the Learner Centered Ideology to this Action Research project, it is important to note some distinguishing characteristics for most high-school students. While this list is far from exhaustive, nor is it universally applicable, it does represent some of the generally-held characteristics of high-school students.

Physical Characteristics. The age of most high-school students in the United States is 14-18, which means that the majority are going through puberty (American Medical Association, 2001). This is an extremely stressful time for teens, because their bodies are changing rapidly, and they are beginning to experience emotions they have not had experience dealing with before, such as sexual attraction or alienation from parents or peers.

Another effect of puberty is the adolescent growth spurt, in which adolescents grow three to four inches a year (Susman & Rogol, 2004). This rapid growth can lead to clumsiness which, coupled with non-uniform growth, can cause negative body image (Tanner, 1972). This will influence other areas besides biological, particularly social, and is one example of the interconnectedness of all areas of development.

High-school students are developmentally diverse, especially due to the effects of puberty occurring at different times, which can affect their ability to participate in activities designed around game dynamics. Additionally, the difference between genders becomes more pronounced throughout puberty, which influences other aspects of development, such as behavior and psychological disorders (Allen, Barrett, Sheeber, & Davis, 2006). These biological differences need to be taken into account when implementing game dynamics into the curriculum.

Cognitive Characteristics. Along with biological changes, adolescents are undergoing sweeping cognitive changes as well. During this period of their life they are still maturing cognitively and are much less able to identify negative emotions exhibited by facial expressions, such as fear and anger. In addition, the cortical regions that are implicated in higher-order thinking, such as self-control and abstract thinking, are not

fully mature (Meschke et al., 2012). Therefore, high-school students often have trouble processing information as quickly or succinctly as adults.

However, most adolescents are beginning to be able to self-regulate, and they are also becoming aware of their self-efficacy (Brassai, Piko, & Steger, 2013). This means that, while they are still new at the process, they are able to evaluate realistically their strengths and weaknesses in order to make informed decisions. However, as discussed in the next section, they are still often impulsive and, though capable, do not exercise restraint.

There is great variance in IQ across all students, which can cause problems in a classroom setting because no two students will progress at the same pace. This means that educators need to differentiate in order to reach students of varying IQ levels. Specifically, there will be an average of one in 17 students outside the normal range, which equates to about one per class on average (Keigher, 2009). This means that most classes will have at least one student who is significantly different cognitively from the other students, either gifted or challenged.

One of the most important areas of cognitive development is metacognition. Nearly all high-school students are able to examine their own thought processes, but some may have not done so before and need to be taught how (Brinck & Liljenfors, 2013). Therefore, teachers need to devote some portion of educational time to teaching metacognitive skills.

In addition, some students will be able to think more abstractly than others (which often relates back to IQ and other biological and social factors). Another example is the level of self-regulation and self-efficacy exhibited by students - some will have only a

basic understanding of their abilities, while others will be fully aware and able to plan their own "learning trajectory" (Ivey & Johnston, 2013). This ability to think abstractly and self-regulate is vital in order for them to benefit from game dynamic implementation.

Behavioral Characteristics. Most high-school students are able to behave in an appropriate manner in the classroom - that is, they are not disruptive, defiant, aggressive, or violent (Burchinal, Lowe Vandell, & Belsky, 2014). Yet, they are more impulsive and take more risks than younger children and adults (Ford, 2008), and are often prone to externalizing guilt and failures (Burchinal et al., 2014), though less-so than younger children.

Another major behavioral factor for high-school students is their desire for ownership of their lives; they think they are "grown," and respond very negatively to patronizing or condescension. This is due to their developing sense of control and responsibility (Merga, 2014; Meschke et al., 2012). When designing lesson plans that include game dynamics, teachers must take these issues into consideration so that they do not put students into a situation in which the temptation to act out may become too much to resist, as well as make sure to build a scaffolding structure to support student independence and agency.

Behavioral diversities are quite varied and can present in a number of outcomes. Common diversities include psychological disorders (Attention Deficit Hyperactivity Disorder, Oppositional Defiant Disorder, Obsessive-Compulsive Disorder, depression, etc.) and other behavioral difficulties. Interestingly, behavioral difficulties in adolescents can often be traced back to early and middle childhood social causes, such as extensive non-parental or grandparent child-care (Burchinal et al., 2014), parental views on

substance abuse (Ford, 2008), or maternal level of education (Bornstein, Hahn, & Wolke, 2013).

Social Characteristics. Adolescents are, by and large, very social creatures. They usually thrive in social situations, especially when socializing with peers, and tend to underperform in extended isolation (Brassai et al., 2013). Peer influences are often the most influential during this stage of their life, so selection of peer groups will have a large impact on individual choice and development (Ford, 2008).

In addition, the great majority of high-school students are fully capable of social learning; that is, learning vicariously through the observation of others (Bandura, 1971; Prati, 2012). This ability has given rise to many therapy techniques in exceptional adolescents (Gifted and Talented, exceptional education, handicapped, etc.), such as bibliotherapy (Eisenman & Harper, 2016).

Some adolescents prefer to be by themselves, though this is often caused by other problems such as Asperger syndrome, abuse, or emotional/intellectual disabilities (Emerson, Robertson, & Wood, 2007). For instance, adolescents who are substance abusers are more likely to not associate with their peers who are not substance abusers (Ford, 2008). Another example would be bullying based on sexual preference causing students to disengage from the hostile environment created by their peers (Prati, 2012). Teachers must remember these atypical students when implementing game dynamics into the curriculum, especially those that rely heavily on social interaction or communal learning.

Summary. It is easy to see from this foregoing discussion that students are very diverse and these diversities need to be considered when constructing any curriculum in

order to maximize student academic engagement, especially one that incorporates game dynamics.

Social Reconstruction Ideology

According to Schiro (2013), Social Reconstruction Ideology can be summarized into three main ideas: (a) society is broken because the methods currently in place for solving problems do not work; (b) society needs to be fixed so that it does not destroy itself; and (c) the main means through which society should be fixed is education. The interesting thing about Social Reconstructionists is that the specific problems with society will vary greatly from person to person, including poverty, racism, crime, illiteracy, political and economic corruption, unemployment, war, and many others. However, the unifying idea is that all of these problems are merely symptoms of an underlying societal sickness, often due to "Eurocentric conceptions of knowledge, culture, and values" (Schiro, 2013, p. 151).

John Dewey (2013) also discusses this ideology when he writes that "education is the fundamental method of social progress and reform" (p. 39). It was Dewey's belief that societal reforms that relied only on "the enactment of law, or the threatening of certain penalties, or upon changes in mechanical or outward arrangements" (p. 39) were destined for failure. Instead, he suggested that lasting, systemic change could only be achieved through establishing a "shared consciousness" (p. 39) that is established and regulated by education, which, as discussed previously, he believed to be a social process.

George S. Counts (2013) described the American society as broken and one that "manifests the most extraordinary contradictions" (p. 47). He follows with a detailed list of societal evils:

> ...dire poverty walks hand in hand with the most extravagant living the world has ever known; an abundance of goods of all kinds is coupled with privation, misery, and even starvation...great captains of industry close factories without warning and dismiss the workmen by whose labors they have amassed huge fortunes through the years...the wages paid to the workers are too meager to enable them to buy back the goods they produce... (p. 47)

After listing examples of how unhealthy American society had become, Counts (2013) follows with, "The age is pregnant with possibilities" (p. 47). He describes how education is the vessel through which societal reform will take place, if only teachers will "increase sufficiently their stock of courage, intelligence, and vision" (p. 45).

If education is the best way to bring about societal reform, as many educational theorists believe, then it is vital that teachers help their students become engaged in the process of being educated. Therefore, if gamification will help students demonstrate more academic engagement, they would be more likely to become academically successful, which could bring about societal reform.

Diversity

One of the best predictors of academic success is the socio-economic status (SES) of the families in which students grow up (Berger & Archer, 2016; Schmitt, Simpson, & Friend, 2011). This has led to a large gap between the academic achievements of students from high-SES families and those from low-SES families. While there are obviously exceptions to this predictor, the fact remains that students from low-SES families are much less likely to be successful. In addition, students from low-SES families are more

likely to have other negative moderators on their life, such as violence (Oni & Adetoro, 2014) or drugs (Ford, 2008).

In addition to SES, there is also a significant academic achievement gap between White students and minority students (Sanchez, Kellow, & Ye, 2000; Scales, Roehlkepartain, Neal, Kielsmeir, & Benson, 2006). While minority status is correlated less strongly than SES, it is still a moderately strong predictor. The fact that many African American students underperform as compared to their White peers is a demonstration of the racism still inherent in the educational system. A concrete example of this is the fact that, while people of color make up 38% of the population (United States Census Bureau, 2016), only 22% of the children's books published in 2016 had a person of color as the main character (Cooperative Children's Book Center, 2017), leading to an underrepresentation of people of color in children's books. This lack of diversity in literature can have a significant impact on children of color who are unable to identify with the protagonists in books, leading to less engagement with their reading, which could result in lower academic performance.

There has been a great deal of research performed on possible interventions to help close this achievement gap, and a variety of possible causes have been identified. Possible causes for the gap include the Matthew Effect (Merton, 1968; Stanovich, 1986), which is the concept that students who begin well tent to have more future successes, while students who are not successful early tend to have significant trouble being successful in the future. This has been summarized as "the rich get richer and the poor get poorer," alluding to the Biblical parable of the talents. Another possible cause for the gap is a lack of structure and support (Davis-Kean, 2005; Pong, Dronkers, & Hampden-

Thompson, 2003). In addition, distractions at home causing a lack of focus on schoolwork is another possible cause (Oni & Adetoro, 2014; Schmitt et al., 2011).

Another aspect of diversity is the differences in perception of games as positive or negative influences. According to the Pew Research Institute (Duggan et al., 2015), African Americans and Hispanics are more likely to view games as positive influences than Whites, even though race and ethnicity are not significant factors in who plays games. This positive perception of games could result in African American and Hispanic students being more engaged in gamified classroom activities due to their more positive perception of games in general.

Historical Context

Early Schools vs. Modern Schools

The appearance of public education has changed a great deal since its inception (Spring, 2014). Students used to be educated in large groups of hundreds or more in a factory-like setting, with one head teacher and several assistants. Now students are usually educated in smaller groups with one or two teachers. The stated purpose for education used to include such goals as "Turning a multicultural society into a single-culture society...Creating nationalism and loyalty to the new government...Regulating freedom through citizenship and moral education" (Spring, 2014, p. 46). Today the purpose of education is varied and often includes preparing students for a rapidly-changing world, to contribute to a global economy, or to become lifelong learners (Sloan, 2012).

However, even though things appear to have changed a great deal, much remains the same. According to Spring (2014):

[T]hese themes in colonial education continue to the present:

- Education is still considered, by some, to be a means of preparing children to obey government laws.
- Education is still considered a social panacea that will eliminate crime, immorality, and poverty.
- Education is still considered, by some, to be a means of maintaining social class differences.
- Education is still considered a source of social mobility.
- Education still must address cultural differences. (p. 14)

In addition to these viewpoints on education shared by many people today, the theories in practice in public education are still closely related to those in practice in the early 1900's (Spring, 2014).

For example, Franklin Bobbitt (2013) was a prominent educational theorist in the early 1900's who believed that education should focus on teaching students specific knowledge and skills that the educators believed they would need to enter the workforce. He wrote, "Education that prepares for life is one that prepares definitely and adequately for these specific activities [that make up human life]" (p. 13). Bobbitt advocated extremely specific standards to guide educators, whom he insinuated could not be trusted with determining a course of study for their students.

This is still the case in the vast majority of schools today, in which teachers have an enormous number of very specific standards to cover. For example, the South Carolina College- and Career-Readiness Standards for English One include 105 specific standards (2015). Considering that there are 180 school days in the traditional school year, this

means that teachers have 1.7 class periods (or just over 94 minutes) to devote to each standard.

The Battle for Curricular Control

Many educational theorists have suggested that teachers be given more autonomy. One example is George S. Counts (2013) who declared that teachers should be given control over their classrooms when he wrote, "To the extent that [teachers] are permitted to fashion the curriculum and the procedures of the school they will definitely and positively influence the social attitudes, ideals, and behavior of the coming generation" (p. 45).

John Dewey (2013) also encouraged that teachers be given control over the curriculum in order to allow them to individualize the instruction for their students. Dewey firmly believed that school was a social construct, and education should be rooted in social learning, and the curriculum should be founded on the social construct of the students and the teacher, thus the teacher would require autonomy in order to construct the curriculum around their microcosm of society as a whole.

Another theorist who favors teacher autonomy is Michael Apple (2013) who argued against the de-professionalism and micro-managing of teachers. He wrote:

> [T]eachers have been involved in a long but now steadily increasing restructuring of their jobs...that they were more and more faced with the prospect of being de-skilled because of the encroachment of technical control procedures into the curriculum in schools. The integration together of management systems, reductive behaviorally based curricula, pre-specified teaching 'competencies' and

> procedures and student responses, and pre- and post-testing, was leading to a loss of control and a separation of conception from execution. (p. 167)

It is easy to see that these educational leaders have long protested the fact that teachers have had little control over the curriculum. However, little has changed in the actual policies of teaching, with the American educational system still maintaining a "top-down" model of curricular control. One of the main ideas underlying gamification is the belief that individual choice increases both engagement and agency. If teachers are given more autonomy in their instructional practice, they will likely become more engaged in it, leading to a better educational experience for the students.

The Standardized Testing Movement

In the early 2000's, there was a major movement in education toward the use of standardized high-stakes testing in an attempt to hold teachers accountable for student learning outcomes (Spring, 2014). This was largely due to the belief that "experts" should be in charge of curricular decisions. One example was Leon Lessinger's book *Every Kid a Winner: Accountability in Education*, which "considered the community control movement a threat to the quality of education" (Spring, 2014, p. 429).

President George W. Bush's No Child Left Behind Act (NCLB) "nationalized federal accountability standards for the purpose of educating global workers" (Spring, 2014, p. 440). This placed severe financial penalties on schools whose students tested poorly on the standardized tests. After implementation of NCLB, many schools began to "teach to the test" (Au, 2013). This caused both a narrowing of the curriculum to tested subjects as well as a change in the form of curriculum to prepare students for standardized testing (Au, 2013). In other words, instructional time and resources were

shifted away from subjects that were not included on the standardized tests, such as music, dance, robotics, and other "non-core" classes into the subjects that *were* tested. Also, the form of instruction changed, showing a reduction in cooperative learning and an increase in lecture and "direct transmission of test-related facts" (Au, 2013, p. 244).

Standardized testing also served to create an artificial dichotomy between cultures, which Sleeter & Stillman (2013) describe as "[setting] up a we/they perspective in which 'we' are of European, Judeo-Christian heritage and English-speaking, and 'they' are not" (p. 265). In other words, a major byproduct of the standardized testing movement was to suppress the culture, language, and perspective of anyone not in the dominant American majority.

Elliot W. Eisner (2013) described the purpose behind the move towards quantification through standardization as "a way to increase objectivity, secure rigor, and advance precision in assessment" (p. 280). Unfortunately, the attempt to quantify the entirety of education has led to significant trouble. Eisner (2013) continues: "But [quantification] is not good for everything, and the limitations of quantification are increasingly being recognized. For example, as standards have become increasingly general and ideological, measurability has become less salient" (p. 280).

Summary

This review of literature includes research related to the development and application of a gamified curriculum model in an 11th-grade high-school Algebra II class. It discusses gamification in general, in both the educational and business contexts. Factors influencing academic engagement are discussed, including factors for academic disengagement. In addition, it establishes an underlying theoretical base Learner Centered

and Social Reconstruction ideologies. Diversity factors are discussed, including the achievement gap and its possible causes. Finally, historical context is provided to help establish the lens through which the literature can be viewed.

CHAPTER THREE: Action Research Methodology

Problem of Practice

The PoP concerns the lack of academic engagement of 11th-grade students in an Algebra II class, evidenced by students not turning in assignments, falling asleep in class, and not participating in class discussions. The teacher-participant expressed a desire to improve her students' academic engagement. She was wondering what kind of impact the incorporation of gamification would have on student academic engagement.

Research Question

What impact will a gamification model of instruction have on the engagement level of 10 11th-grade students in a high-school Algebra II class?

Purpose Statement

The purpose of this Action Research project is to examine the impact of a gamification model of instruction on the engagement level of 11th-grade students in a high-school Algebra II class.

Action Research Method/Design

One of the key differences between action research and traditional research methodology is the dual role of the researcher as a researcher as well as the implementer of the research study (Trondsen & Sandaunet, 2008). In this study, the researcher's role will be to work with the teacher to modify her classroom instruction and assessment in a

way that incorporates the Game Dynamics curriculum model. The researcher will fulfill the researcher role by collecting data from the teachers and students through the data-collection instruments discussed below, analyzing the data, and drawing conclusions.

An observational study is a type of research study in which a sample is observed while the researcher is not able to manipulate the independent variable. This study will utilize the observational study methodology because the researcher will not be delivering the treatment to the student-participants. Therefore, the researcher will observe the teacher-participant and student-participants in order to draw inferences about the efficacy of the treatment.

Overview of Treatment

What follows is a brief overview of the specific identified game dynamics included in the gamified curriculum reflected in this study.

Incremental Progression. This game dynamic can be defined as *the idea that people perform better if they are able to experience continual progression, no matter how small, towards a goal*. One example of this game dynamic is in Role Playing Games, such as Dungeons & Dragons (Heinsoo et al., 2008) in which players accrue Experience Points by completing tasks and defeating enemies, and the players become more powerful as they gain more Experience Points.

In this research project, *Incremental Progression* is created through a reframing of class grades. Instead of traditional percentage grades, students are given "Experience Points" (XP) for each assignment, depending on their level of mastery. This is simply a reframing of the traditional points system used in most college courses. These points will

never decrease, thus students get the sense of continual progression throughout the course.

Multiple Routes. This game dynamic can be defined as *a system in which participants have multiple options in how to progress towards a final goal*. An example of this game dynamic is Chess, in which there are functionally infinite variations of moves which players can make as they pursue their goal of capturing the enemy King.

In this research project, this dynamic is created when the teacher offers students a choice between several possible summative assessment formats.

Psychosocial Moratorium. James Paul Gee (2007) defines this game dynamic as a system in which "[l]earners can take risks in a space where real-world consequences are lowered" (p. 222). This game dynamic can be observed in the video game *Super Mario Bros.* (Nintendo, 1985) in which players who fail are immediately allowed to try again, thus encouraging learning through trial and error.

In this research project, this dynamic is created by the class policy that students can redo any grade they would like, as well as the teacher's conscious effort to praise "forward failing" in class discussions, vastly decreasing the negative consequences for taking risks.

Setting and Time Frame of Study

In order to protect the confidentiality of the participants and setting, student numbers are used throughout the study. The site for this Action Research project is "East High School," a Title I high school in South Carolina. The school has a total student population of 1,244 students and 80 teachers, for a student-to-teacher ratio of 15.6:1

(Source redacted to ensure participant confidentiality). The student population is composed of 72% African American and 28% White students. The community is composed of 57% White, 41% African American, and 2% Hispanic/Latino citizens. High-school graduates make up 81% of the population, with 16% having obtained an undergraduate degree or higher. The median household income is $35,494, with 25% of the population classified as living in poverty, and the unemployment rate is 5.9%. The median home value in this area is $73,210, and 42.7% of residents rent their home.

Participants

This Action Research project will draw 10 participants from one class of Algebra II students. The demographics for this student population are 70% African American and 30% White. All students at this school are eligible for free lunch.

The 10 student-participants are described as follows. Comments about academic engagement are based on pre-treatment observations:

- S#1 is a 16-year-old White female. She appears friendly and academically gifted, and seems focused on grades and academic achievement. She appears to be engaged during instruction and independent work, but seems to get off task when working with others, tending to socialize instead of working.
- S#2 is a 17-year-old White female. She appears friendly and social, spending much of her time talking with other students. She is classified as Gifted and Talented and appears very intelligent, yet her GPA is only 2.7, possibly because of her focus on socialization over academics.

- S#3 is a 16-year-old African American female. She is more withdrawn socially than most of the other students. She seems to work very hard on her schoolwork, but struggles academically. She is usually engaged throughout the class and asks lots of questions.
- S#4 is a 16-year-old White female student. She is an outspoken critic of school in general, and seems to dislike this school in particular. She appears friendly and spends most of her time in class socializing or reading, and never participates in class discussions unless asked a direct question. S#4 identifies as bisexual.
- S#5 is a 16-year-old African American female. She does not appear friendly, and often argues with those around her. She does not seem engaged, spending most of her time in class on non-instructional websites.
- S#6 is a 16-year-old African American male. He appears exceptionally friendly and is usually smiling and upbeat. He seems to be somewhat engaged, especially during collaborative work, but sometimes gets off task. He appears to be very good friends with S#8.
- S#7 is a 16-year-old African American female. She appears friendly and academically gifted. She is very social, spending much of her time in class talking with friends, but is still able to complete her work quickly and accurately.
- S#8 is a 17-year-old African American male. He appears friendly but struggles academically. He plays on multiple school sports teams (football, basketball, and track). He appears to usually be disengaged,

staring out the window or drawing in his notebook instead of participating in class activities.

- S#9 is a 16-year-old African American female. She does not talk much, and seems aloof from those around her, often choosing to work alone instead of with a partner or group. She appears mostly disengaged, spending most of the class time on non-instructional websites.
- S#10 is a 16-year-old African American female. She appears very friendly and outgoing, with many students in the class looking to her as a leader. She is usually academically engaged, but also voices concerns that learning the material is a waste of time due to it not applying in the real world.

The teacher-participant was selected because she participated in professional development that focused on using educational games in the classroom, and she expressed interest in incorporating games and gamification into her classroom practice. The teacher-participant is a veteran teacher of eight years, and has taught at this school for the last six years. She has taught Algebra II for the past four years, as well as Pre-Calculus and Trigonometry. She is also the sponsor of the student technology club. The teacher-participant is 31 years old, and seems to be very well liked by most students and staff.

Action research is often conducted on a small number of participants (Efron & Ravid, 2013) By choosing a sample size of 10 participants, the research was able to gather data from a relatively wide variety of sources, thus increasing reliability. However, the sample size of 10 participants is much too small to make any claims of

generalizability to other populations, meaning that further research will need to be conducted.

In keeping with research best practices, students were presented with the choice to opt out of the study if they so desire. All data collected was completely confidential, and was stored either in a locked file or on the researcher's password-protected personal computer, to which the researcher has sole access. Participants were assigned numbers, and the identification codes were stored separately from the actual data to ensure confidentiality.

Design of the Study

According to Mertler (2014), there are our distinct stages of an action research project: (a) identifying an area of focus, (b) data collection, (c) data analysis and interpretation, and (d) developing a plan of action. Each of these stages builds upon its predecessor, creating a systematic methodology for conducting action research. This research study follows this process, with each of the steps briefly outlined below.

Identifying an area of focus. The first step of any action research project is to identify an area of focus and conduct planning in order to design the project before implementation can begin. For this project, the researcher identified a problem of practice, which the researcher used as the foundation of the research question and statement of purpose. After identifying the problem of practice, the researcher conducted a literature review in order to gain a deeper understanding of the problem, which informed his research question and purpose statement. The researcher then developed the research plan. In summary, the researcher will work with one teacher to incorporate a

gamified curriculum and collect data to determine its effects on the academic engagement of 10 students.

Evolution of the research plan. The initial plan for this research was designed when the researcher was a high-school ELA teacher. The researcher planned on implementing the Game Dynamics curriculum model into his own instruction and gathering data from his students about its effects on their academic engagement. However, the researcher was promoted to an administrative position based in the district office, which means that he will not be able to implement the plan as it had originally been conceptualized.

Instead, the researcher plans on partnering with one classroom teacher to develop a unit for her classroom that uses the Game Dynamics curriculum model, which she will implement with her students. The researcher will collect data from both the teacher and the students. This means that his role changed from a teacher-researcher to a curriculum designer-researcher, as he will not be directly instructing students using the Game Dynamics curriculum model.

Development of the research plan. For this research project, the researcher plans on using a multiple-group pretest-posttest observational study design. This methodology will allow him to collect a steady stream of data throughout the entire project as well as establishing a "deeper quality of trust that motivates the participants to share with [the researcher] what they otherwise might not want to or feel comfortable doing" (Mertler, 2014, p. 93). In addition, it will allow the researcher to fulfill the "participant as observer" role (Mertler, 2014) by working with the teachers to construct the instructional unit and collect data on its effects on academic engagement.

Ethical considerations. It is vital that, when conducting any research, researchers consider the ethical ramifications of their proposed study and follow ethical guidelines in its implementation. This research project was submitted to the Institutional Review Board (IRB) at the University of South Carolina before research began, to ensure that the rights of all subjects are protected. The researcher will also make it plain that participation is in no way required and deciding not to participate will have no negative effects on any participant.

This action research project also follows "the principle of beneficence" which Mertler (2014) describes as stating that "research should be done in order to acquire knowledge about human beings and the educational process; in other words, it should benefit someone or some group of people. It should never be conducted as a means of doing harm...or to denigrate, find fault, or suppress academic progress" (p. 112). The purpose of this research is to gain a better understanding of gamification's effects on academic engagement in order to help all students be more academically successful.

It is important for researchers to account for other ethical considerations, such as honesty and conflicts of interest. This study will include only honest information and the researcher will strive to excise any bias from his interpretation of the data. The researcher will also make sure that the primary focus of the instructional unit designed for this study remains student instruction, and that the incorporation of the Game Dynamics curriculum model will compliment instruction, not hinder it.

Sample

This research project used a voluntary sample of participants. The researcher conducted professional development on incorporating the Game Dynamics curriculum

model to teachers throughout the district, and the researcher selected a volunteer from the teachers to participate in the study. From this voluntary sample, a convenience sample of student-participants was used. Because of these sampling methods, the generalizability of this study is reduced, which is one of the identified limitations.

Data Collection

The second step of action research is to collect data (Mertler, 2014). For this research project, data was collected before implementation, during implementation, and after implementation. This gave the researcher an ongoing stream of data from which to draw conclusions.

Data was collected from both student-participants and teacher-participants, using a variety of methods. The teacher-participant and student-participants were given Likert-scale pre- and post-treatment questionnaires that focused on the level of student academic engagement, as well as gathering demographic information about the student-participants (Appendix A). The Likert-scale format was chosen because it allows for tangible, quantifiable measurements of attitudes (Grim, 1936). This allowed for comparisons to be made between pre- and post-treatment data, showing changes in student behavior and attitudes. The student-participants were also given structured interviews (Appendix B), as was the teacher-participant (Appendix C), which served to flesh out the data and provide an opportunity for participants to voice their perceptions about the efficacy of the treatment, as well as providing qualitative data that served to build context that informed the analysis of data. The teacher-participant also took anecdotal notes. The researcher took field notes during class observations as well as collecting artifacts of student work.

Data collection timeline. The timeline for data collection was as follows:

1. Professional Development on Game Dynamics: August - December 2017
2. Selection of Teacher Volunteers: October - November 2017
3. Pre-Implementation Questionnaires and Interviews: March 2018
4. Implementation of Game Dynamics Curriculum: March 2018
5. Second Phase Data Collection: March 2018 - May 2018
6. Final Phase Data Collection: May 2018

Procedure. The following table presents a brief summary of the researcher's classroom observations, including which game dynamic(s) were incorporated into the observed lesson.

Table 3.1 – Observation Summaries

Date	Brief Description
3/19/18	The researcher introduced the research project to students and answered their questions. Student-participants completed the attitudinal pre-survey.
3/26/18	The teacher revealed the Leaderboard (Incremental Progress [IP]). Students worked on a project that they were allowed to submit multiple times, with only the best submission counting as a grade (Psychosocial Moratorium [PM]).
4/2/18	Spring break – no observation
4/10/18	The teacher updated the leaderboard before class (IP). She also handed back work that had been graded using the XP system (IP). Students were required to complete a quiz in the digital learning management system (Schoology), and they were allowed to take it as many times as they wanted, with only the highest scoring submission being counted (PM).
4/17/18	The teacher updated the leaderboard before class (IP). She also introduced the next major project: groups of students are to create videos that demonstrate logarithms. Students were given significant choice in the format of this video (Multiple Routes [MR]). Students debated which option to take in their groups.

4/26/18	The teacher updated the leaderboard before class (IP). The teacher introduced the next project: students will work with a partner to create review activities for each other, covering the topics that will be on the unit test. Students were given significant choice in the format of the review as well as the number of review items (MR).
4/30	The teacher updated the leaderboard before class (IP). Students work in pairs to complete an EdPuzzle activity that awards XP (IP).

Data Analysis and Interpretation

Data will be analyzed in order to "bring meaning and order to the mass of collected data by looking for recurring themes, categories, and patterns" (Efron & Ravid, 2013, p. 166). Qualitative data will be coded for themes, categories, and patterns. Once these recurring themes, categories, and patterns emerge, they will be organized using a concept map and supported with evidence, following best practices of grounded theory (Glaser & Strauss, 1999). When multiple data points demonstrate positive results, they will suggest that the strategy was effective. However, when the data points demonstrate negative or null results, or the data points are contradictory, they will suggest that the strategy was not effective. Triangulation will be used when drawing conclusions in order to improve accuracy of conclusions (Efron & Ravid, 2013).

Qualitative methodology. This research project will mostly use a qualitative rather than a quantitative methodology. There are several reasons for this choice, such as the difficulty in quantitatively measuring academic engagement. Because academic engagement is, by definition, somewhat subjective, it is extremely difficult to measure quantitatively (Fredricks et al., 2016). The qualitative measures will be supported by one quantitative measurement: Likert-scale questionnaires. This will allow some of the data to be quantitatively analyzed, giving increased accuracy and objectivity to the results.

Transcription. Only student and teacher interviews will require transcription, and the process will be as follows: the researcher will record the interviews using Swivl recording hardware and software, and then transcribe the responses using Microsoft Word 2013.

Data Analysis

The data will be analyzed in order to "bring meaning and order to the mass of collected data by looking for recurring themes, categories, and patterns" (Efron & Ravid, 2013, p. 166). Once these recurring themes, categories, and patterns emerge, the researcher will organize them using a concept map, supporting findings with evidence, following best practices of grounded theory (Glaser & Strauss, 1999). Triangulation will be used when drawing conclusions in order to ensure validity and reliability (Efron & Ravid, 2013).

Plan for Reflecting with Participants on Data

After completion of the action research project, the researcher will present the results to the class, including both the teacher and the students. The researcher will then ask for feedback from the participants to gain a deeper understanding of how they were affected by the Game Dynamics curriculum model.

Developing a Plan of Action

The purpose of any meaningful research is to apply the findings, so the researcher will apply the findings in various educational contexts. Because the researcher has transitioned to a role in higher education, and is no longer a classroom teacher, he hopes to provide professional development to current and future math teachers who could use it

to improve academic engagement in their classrooms. He will also talk to school- and district-level administrators in order to expand their understanding of the benefits of gamification. In addition, he will present the findings in various workshops and educational conferences.

Summary and Conclusion

The methodology for this action research plan will be a multiple-group pretest-posttest observational study design, in which the researcher partners with one teacher-participant to modify specific parts of her of instruction and assessment based on the Game Dynamics curriculum model. Data collection will focus on student academic engagement and will include mainly qualitative measures, such as open-ended questionnaires, semi-structured interviews, and anecdotal notes. There will also be a quantitative component in the form of Likert-scale questionnaires. Teacher- and student-participants will contribute data before, during, and after implementation of the instructional unit. After data collection is complete, a data analysis will be performed, using best practices of grounded theory (Glaser & Strauss, 1999) and triangulation in order to support inferences drawn as a result of the study. After completion of data analysis, an action plan will be developed based on the analysis and how to use it to improve teaching practices.

CHAPTER FOUR: Findings from the Data Analysis

Introduction

The focus of this study was to determine the effects of a gamified model of instruction on 10 11th-grade Algebra II students' academic engagement. The student-participants in this study were often academically disengaged in class, evidenced by not completing assignments (or not completing them on time), not participating in class discussions, falling asleep in class, and talking about class topics with derision. The teacher-participant also expressed concern regarding lower than expected academic achievement, which could be another sign of academic disengagement (Chen, 2014; Petscher, 2010). The researcher worked with the teacher-participant to institute specific changes to the instruction and assessment to incorporate the game dynamics of Incremental Progression, Multiple Routes, and Psychosocial Moratorium (Gee, 2000).

Research Question

What impact will a gamification model of instruction have on the engagement level of 10 11th-grade students in a high-school Algebra II class?

Purpose of the Study

The purpose of this study was to examine the impact of a gamification model of instruction on 10 11th-grade students in an Algebra II class.

Findings of the Study

Over the course of six weeks, the researcher collected data from one teacher-participant and 10 student-participants related to the student-participants' academic engagement. The data was collected utilizing five instruments: pre- and post-questionnaires, teacher-participant journaling, pre and post semi-structured interviews, student artifacts, and researcher field notes. The following section will begin with a discussion on the themes that emerged from the data, followed by a discussion on the overall results of the pre- and post-implementation questionnaires.

As a result of carefully examining the data sets, three themes emerged: (a) the effects of incremental progression, (b) the effects of meaningful choice, and (c) the effects of reduced consequences. Each of these themes will be explored below. Following that exploration will be a discussion on the overall results of the pre/post survey.

Theme One: The Effects of Incremental Progression

For the purposes of this study, and drawing from the work of Gee (2007) and Deterding et al. (2011) Incremental Progression is defined as the idea that people perform better if they are able to experience continual progression, no matter how small, towards a goal. In this research study, this is represented by the modification of the way that grades are presented to the students. Instead of the traditional percentage system, the teacher-participant used the total-points system and gave students points (called "experience points" or "XP") for each assignment. This is identical to the total points system used in many schools and universities, with the only modification being what the points were called (e.g. "XP"). Once earned, points never decrease, which gives students the sense of continual progression. This is mathematically identical to the percentage

system – it is simply presented to the students in a different manner, framing it as a game element.

For example, if a student completes a homework assignment worth 50 XP and they make a perfect score, they would receive all 50XP. Then they take a quiz that is worth 100XP and make another perfect score, earning another 100XP, bringing their total to 150XP. Then, the student completes an assignment incorrectly and only earns half of the possible 100XP. This means he would earn 50XP, bringing his total up to 200XP out of a possible 250XP. This example illustrates that the system itself is not new; rather the way that it is presented is the modification.

Overall, the data suggests that the majority of students were much more interested in and motivated by receiving XP compared to traditional percentages. This can be found throughout all the data points, but it most clearly indicated in the researcher's field notes, teacher journaling, and student interviews.

In the researcher's field notes, there are several instances of students showing interest in the XP system and being willing to put forth more effort to obtain XP. For example, "S#6 is visibly excited about the XP system. He has brought it up in conversation five times in this class, three of which were with S#8, who is less excited but still seems somewhat excited." S#6 was very excited throughout the treatment, especially at the beginning.

Additional evidence supporting increased engagement was that, even though the school is a 1:1 device school, meaning every student has a MacBook and teachers are encouraged to do as much digitally as possible, nine of the 10 student-participants still kept up with their paper XP charts and used them often.

On the first day of the implementation, the teacher-participant had the students create avatars, which would represent them in the class, much like a videogame player creates a character. She then used these anonymized avatars to create a "Leaderboard" that displayed students who earned the most XP. Several students were very competitive and worked very hard to remain on the Leaderboard. S#6 in particular was very committed to remaining on the Leaderboard, remarking on his position most days (e.g. "Sweet, I'm number two!"). This continued to the point that, when he did not earn enough XP to remain on the Leaderboard later in the study, he checked with the teacher-participant every day to see how close he was to getting back on. This sentiment was also reflected in the student semi-structured interviews, such as when S#2 said, "I was excited, I was pumped up…It's gonna' be something new and more competitive…I personally started to try really hard. I was kinda' getting up there, and I had a goal to get over a million points…" She continued, "I think it would be more fun to do it [in other classes] and more kids would get motivated to do [their classwork]." This student was consistently on the Leaderboard for the entirety of the study, often in the first-place spot. S#7 was also motivated by the XP system, saying, "I had wanted to be the top of the class, but [S#2]…kept knocking me back." S#8 was also interested at first, going to far as to take his avatar home when he did not finish it in class, which the teacher-participant said was an anomaly for him, because he "rarely does homework" and she has to prompt him often to stay on task in class.

The teacher-participant's journaling also reflects the theme of Incremental Progression. For example, on the first day of implementation, the teacher participant

"asked why [S#4, S#8, and S#9 were excited about the XP system], and they each said something like, 'I love video games, and I think this will be more fun'"

This theme continued throughout the teacher-participant's journal, such as when describing student reactions when they received their first piece of graded work that had XP totals instead of percentages, she wrote, "When I gave it back with the +500xp all the kids pulled out their XP sheets and filled in the bars. [S#6] said 'Man, we already halfway to level 1!'" She also described their reaction to seeing the Leaderboard for the first time: "The kids seemed excited, esp. [S#6 and S#1], who were in first and second place." She also wrote, "The kids seemed excited, [especially] [S#6 and S#1], who were in first and second place."

Further journal entries continue to support this theme: "[S#6] is super excited about the XP system. He talks about it multiple times every day, constantly trying to get as much XP as possible…[S#1] is also excited, but she doesn't talk about it as much, probably because she doesn't want to annoy everyone like [S#6] is doing." Also, "[S#1] responding to [S#8] about the XP system: 'I love it, since my XP just goes up. I know it's the same, but it's not discouraging since I don't have to watch my hundred drop to 90 if I choke a test.'"

The teacher-participant also noted increased participation after implementing the XP system. She wrote, "I am noticing more student participation, especially in whole-class discussions. The kids are asking more questions…" This is also supported by student interviews, such as S#1 saying, "I always ask questions if I don't understand, but hardly anyone else did, but now more people are asking questions if they don't get it."

The student-participant interviews also supported the idea that students were more engaged after the implementation of the new XP grading system. For example, S#8 said, "The XP kinda' make me work harder…normally I forget to do my work, but I be doing it more now." S#10 echoed this feeling, "I see the total points that could have been made, then the points that you made…And I be like, 'Aw man, I could have did better.' So sometimes the work isn't even that hard, and it makes me feel a little guilty because I knew I could have done it. So the next time I remember and I get it done."

The idea of increased completion of work due to the XP system is also evidenced by S#4's comment that she was "more likely [to complete work] now, because it bring our points up." S#7 agreed with this sentiment, saying, "I wish other teachers would use this, but just not with homework [because]…I be doing homework all the time." Both of these students recognized that they were more likely to complete their assigned work after the implementation of the XP system, evidencing higher academic engagement. The teacher-participant's journal also reflects this: "More students are turning in homework than before. Usually I would have about a third of them turn it in on time, and another third or so turn it in late. Now about 2/3 are turning it in on time, and most of the others are turning it in late. [S#8] is still a problem, and only turns in about half of his work, but even that's an improvement."

Yet, it is important to note that not all students were motivated by the XP system. For example, S#5, did not like it. When it was first introduced, she said she did not understand and did not want to do it. Later in the study, she reiterated, "Why we have to do this?" and "So, what's [5000xp] in real grades?" Still later, during the semi-structured interviews, she said, "[The XP system] was too much to keep up with…I'm like, 'Oh, I

hate this.'" The teacher-participant's journals entries show S#5's attitude: "[S#5] is still being difficult, complaining about the grades every time she gets a grade back." These statements, among others, clearly indicate that she was not interested in the XP system and did not want to participate in it.

In addition, S#9 seemed to have a neutral response to the XP system. At first she said, "I thought it was gonna' be better [than the percentage system] and help, but then it confuse[d] me…But I'm good now and I like it." Overall, she went back and forth, with the net result of little change in engagement.

Finally, it is important to consider that engagement with the XP system was much more widely effective at first, but some students were less affected by it as time went on and it lost the "novelty factor." While it was still somewhat motivating for most students, it was mentioned less and less as time went on. The effects seemed to plateau around the fourth week – four students were still very interested (S#1, S#2, S#6, S#10) while six were only mildly influenced.

Even considering that the effects decreased over time, eight of the 10 students ended the program demonstrating a higher level of engagement than when they began the treatment. Even though S#5 was resistant to the XP system, the data nevertheless revealed that there was no negative effect on her level of engagement. S#9's engagement was also largely unaffected by the implementation of the XP grading system. Therefore, of the 10 student-participants, eight demonstrated increased academic engagement and two demonstrated no significant change in academic engagement, evidencing that the treatment was effective with this group of students-participants.

In summary, incremental progression is the idea that most people will better progress towards a given goal when they see consistent progress, no matter how small. This was implemented in this research study through the use of a points-based grading system rather than the traditional percentage-based system. The points were called "XP" (short for "Experience Points"), reflecting many popular games.

The majority of students expressed increased interest in the new grading system compared to the old one, and the addition of the Leaderboard encouraged competition. Many students also expressed that they liked how they could not lose points, which supports the sense of continual progression instead of the "two steps forward, one step back" many experience with percentage grading. Even though the grading system is mathematically identical, the presentation as points that never go down helped most students engage with their work more effectively.

This theme supports the conclusion because students were more engaged in their classwork as a result of the Incremental Progression game dynamic introduced by the XP grading system.

Theme Two: The Effects of Meaningful Choice

Another identified theme is the idea that students in this study were more likely to be engaged with an assignment when they were given meaningful choice. This demonstrates the "Multiple Routes" game dynamic. As discussed in Chapter 2, the Multiple Routes game dynamic can be defined as *a system in which participants have multiple options in how to progress towards a final goal.* The teacher-participant designed several assignments that allow for significant student choice, and the students

demonstrated higher levels of engagement in these assignments compared to those in which they have no choice.

One of these assignments was a project that involved students creating a video that "demonstrates logarithms in the real world." Students had a great deal of choice in this project, including the format (e.g. music video, public service announcement, commercial, or news report), the script, and all the other elements that come with making a video, such as setting, music, editing preferences, etc. After the teacher-participant introduced the project, she assigned students into groups and told them they needed to choose a format and begin working on the script. The students were in three groups of four students each:

- S#1, S#3, S34, and S#10
- S#2, S#7, and S#9
- S#5, S#6, and S#8

Students in the first group were very engaged, holding an animated discussion to choose the format for their video. They decided on a news report, reasoning that all four participants could have speaking roles (two anchors, a field reporter, and sports). It is important to note that all of the group members wanted active speaking roles in the video, rather than behind the scenes roles. This demonstrates higher academic engagement, because they wanted to be actively involved with the creation of the video and wanted others to see them in it.

Most of the students in the second group were also engaged, though S#9 was very quiet and seemed distracted. The teacher-participant later said that she had recently broken up with her boyfriend and had been "really mopey this week." However, the other

two members of the group were very engaged and decided on a music video, with S#7 singing, S#2 editing and writing the lyrics, and the other members playing backup singers/dancers. All students in the third group were engaged, to the point that the teacher-participant had to ask them to be quiet. They were arguing over the format, but eventually decided on a news report after S#8 said he no longer cared what format they did.

Over the course of the next week, students wrote, recorded, and edited their videos. The teacher-participant said that several students asked if they could come use her room to record in during their lunch or activity periods, indicating that they were very engaged in this project, because they were willing to give up their free time to work on it.

The teacher-participant noted student engagement in this project, stating, "They…liked the fact that they get to choose what type of video to make." She also noted S#10 saying, "[Teacher], why you making us do a video? Yeah, it's fun, but it's a ton of work. Can't we just do a test or something?" This presents a paradox: the student was interested in making the video, and thought it would be fun, but still did not want to do it because it took more effort, and she would rather have something less fun (a test) as long as it required less effort to complete.

The idea of meaningful choice increasing engagement is reflected in the student-participant interviews, such as when S#6 said, "[At first I thought] 'Oh, this gonna' be easy'…but it's actually more challenging." He initially thought that having choice meant he could choose whichever was easiest, but he ended up making choices that interested him, even if they were more challenging. S#8 echoed this, saying that "[There has been] a big change from earlier. I work a lot more harder now."

In summary, students in this study were presented with three assignments in which they had meaningful choice. All three assignments showed higher-than-average levels of student academic engagement. For the group assignments, much of the engagement centered on making the meaningful choices, such as which format to use for a video. This gave students a significant sense of ownership of their work, which previous research suggests increases academic engagement (Evans & Boucher, 2015; Wang, Huang, & Hsu, 2015).

This theme supports the conclusion because students were more engaged when working on these assignments as a result of the Multiple Routes game dynamic, brought about by the incorporation of meaningful student choice.

Theme Three: The Effects of Reduced Consequences

The third identified theme is that the students in this study demonstrated increased academic engagement when the consequences for failure were reduced. The notion of reducing consequences for failure is an example of the Psychosocial Moratorium (Gee, 2007) game dynamic. That is, the teacher-participant incorporated several assignments into the curriculum that allowed students to submit work multiple times, with only the best submission counting toward their grade. This is very different from the traditional classroom, in which students have one attempt on practically all assessments, and whatever score they receive is immutable. However, one excellent way to learn is through trial and error and learning from mistakes with targeted feedback and guidance, so these assignments were designed to encourage students to try, fail, and learn from their mistakes.

One such assignment that students were able to submit multiple times was the Parabola Project, in which students recorded themselves (or a volunteer) shooting a free throw. They then took screenshots of various frames of the recording, noting the placement of the basketball and mapping its parabola. They mapped a graph on top of these pictures and calculated the equation that would produce the same parabola. Because of the complexity of this project, the teacher-participant chose it as one that students could submit multiple times.

When this project was first introduced, students were told that they could submit the project as many times as they wanted, and the teacher-participant would give them feedback each time and only count the highest-scoring submission in the gradebook. When the teacher-participant informed the students, "they were even more excited." Most of the students took advantage of this opportunity, with eight of the 10 students submitting the project (S#8 and S#9 did not turn anything in). The teacher said, "This is an improvement over past projects – normally I get about 2/3 of the class to turn in projects, and many of those are late by several days. This time I only had one late project, [S#6]…most of them turning it in 2 or 3 times." Similar results were repeated in the other Psychosocial Moratorium assignments the teacher administered during this study.

The students were willing to put forth a great deal of additional effort in order to improve when they knew that they would not be penalized for failure. For example, S#4 said, "I love that you're doing these [Psychosocial Moratorium assignments]…They be helping my grade so much." This is an example of a Psychosocial Moratorium being effective in improving student academic engagement, especially since all but one of these

students turned in their work multiple times before the deadline, when "many" of them usually submit late.

In summary, the students in this research study were presented with three assignments in which they had the opportunity to submit multiple products, receiving feedback for each submission, with only the highest-scoring submission being entered into the gradebook. This was based on the Psychosocial Moratorium game dynamic (Gee, 2007), which states that people will be more likely to "fail forward" and take chances that lead to learning from their mistakes if the real-world consequences for failure are reduced.

When students in this study were presented with the ability to submit an assessment multiple times, most did so, even though it required significantly more time and effort to do so. This demonstrates that they were more engaged in the assignment, because they were willing to work to learn from their mistakes and resubmit – something that would not be possible if they were not allowed to submit multiple times.

This theme supports the conclusion because students were more engaged with these assignments as a result of the Psychosocial Moratorium game dynamic, brought about by the ability to fail and try again without significant consequences.

Overall Results of Pre- and Post-Implementation Surveys

The pre- and post-implementation surveys were composed of Likert-scale questions that asked students to respond on a 1-5 scale. They included questions about the student's demographics, their attitudes towards games and gaming, their attitudes towards school in general and their school in particular, and their activities related to the Algebra II course.

Results of the pre- and post-implementation surveys indicated that academic engagement increased somewhat for most students after the game-dynamic framework was instituted (See Figure 4.1 and 4.2). Students (S) #6, #8, and #10 were especially affected, showing signs of increased engagement across a wide variety of indicators. S#1, S#2, S#3, S#4, and S#7 showed signs of slightly increased engagement across a few indicators. Students S#5 and S#9 showed no significant signs of increased engagement.

Asking questions and participating in discussions. The comparison of pre- and post-test data show that most students asked more questions and participated more in class discussions after implementation. Before implementation, only S#10 indicated that they asked questions or participated in discussions "very often." However, after implementation, the students who indicated they participated in discussions "very often" included S#3, S#6, S#7, and S#8, as well as S#10. S#4 and S#5 also indicated in increase in participation to "often." No student indicated a decrease in discussion participation.

Homework. The surveys also indicated an increase in students completing assigned readings and homework assignments after implementation. Before implementation, only S#1 indicated that they "never" come to class without completing homework assignments, and S#4, S#6, and S#8 indicated that they "often" or "very often" come to class without completing homework assignments. After implementation, S#4 and S#6 indicated that they usually complete their homework before coming to class.

Asking students for help. The survey data indicates that students were more likely to ask other students for help with class concepts after implementation of the game-dynamics framework. Prior to implementation, S#1, S#4, and S#10 indicated that they

"often" or "very often" asked other students for help understanding course material, while S#2, S#6, and S#7 chose "usually not." All other participants chose "sometimes." After implementation, S#1, S#2, S#3, S#4, S#8, and S#10 indicated they asked for help from a classmate "often" or "very often" and S#6 said he "sometimes" asked for help from fellow students.

Explaining material to fellow students. Several students, including S#1, S#2, S#6, and S#7, indicated that they "often" or "very often" explain class material to other students on the pre-implementation questionnaire. After implementation, S#3 and S#4 also indicated this. The only student who indicated a decrease was S#8.

Discussing class material with other faculty members outside of class. Before implementation, the only students who indicated that they discussed class material with other faculty members were S#8 ("often") and S#9 ("sometimes"). However, after implementation, S#4 and S#8 indicated that they "very often" did so, and S#7 and S#9 indicated that they "sometimes" did so.

Discussing class material with other students outside of class. The survey data shows that Only S#4 and S#9 "often" or "very often" discuss class material with other students outside of class, while S#1, S#5, S#6, S#8, and S#10 chose "usually not" or "never." However, after implementation S#3, S#8, and S#10 indicated that they "often" or "very often" do so, and S#6 went from "never" to "sometimes." S#7 decreased from "sometimes" to "usually not" and S#9 decreased from "often" to "sometimes."

Skipping class. The final question of significance on the questionnaires asks if students skip class. The data shows that instances of students skipping class decreased

significantly after implementation. S#4, S#5, S#6, S#8, S#9, and S#10 reported a decrease in skipping class. Particularly, S#10 went from "very often" skipping class to "never" skipping class. No students reported an increase in skipping class.

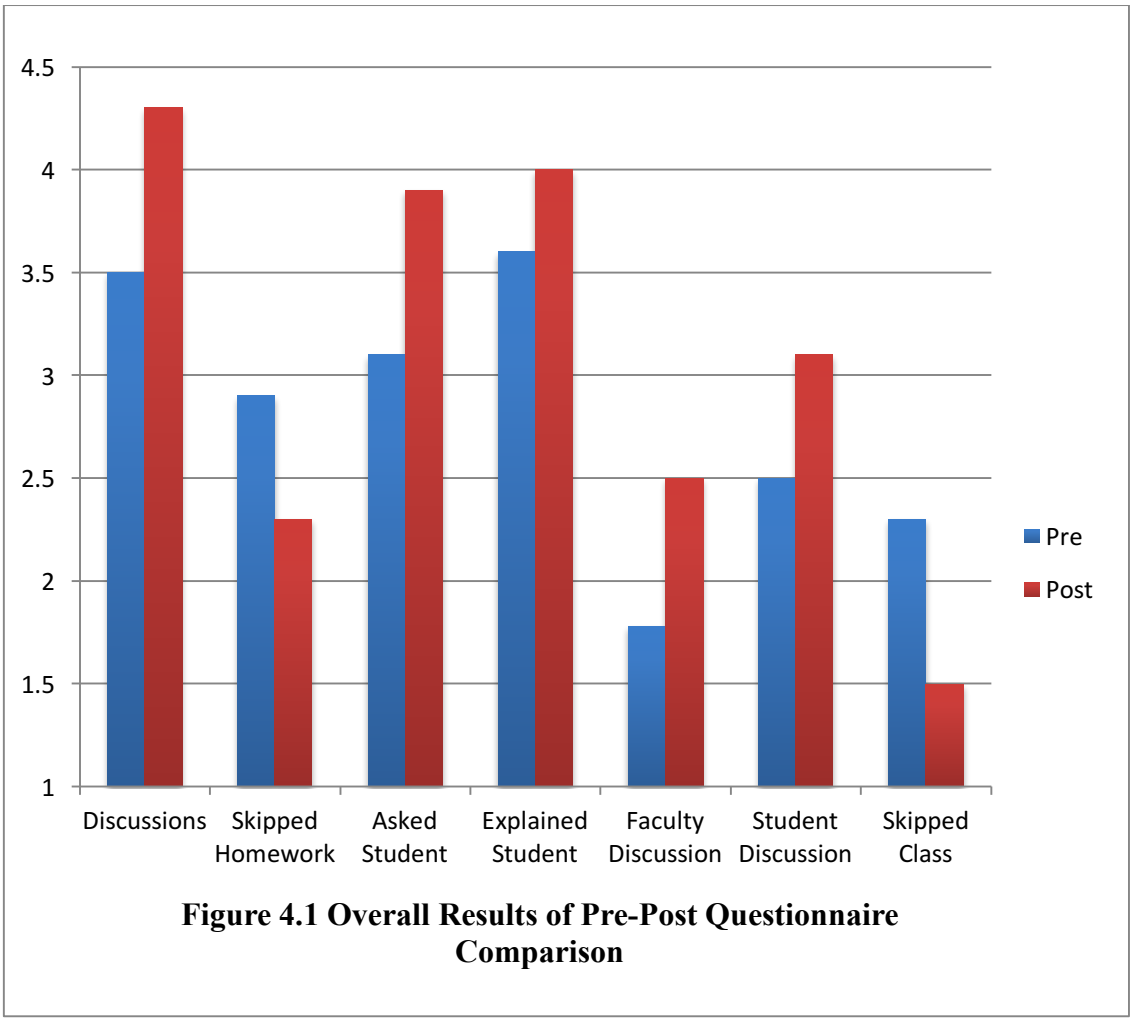

Figure 4.1 Overall Results of Pre-Post Questionnaire Comparison

Table 4.1 Select Questionnaire Questions

Label	Question Text on Questionnaire	Pre	Post	Change
	About how often have you done the following in THIS CLASS…			
Discussions	Asked questions or contributed to class discussions in other ways?	3.5	4.3	+0.8
Skipped Homework	Come to class without completing readings or assignments?	2.9	2.3	-0.6
Asked Student	Asked another student to help you understand course material?	3.1	3.9	+0.8
Explained Student	Explained course material to one or more students?	3.6	4.0	+0.4
Faculty Discussion	Discussed course topics, ideas, or concepts with a faculty member outside of class?	1.778	2.5	+0.722
Student Discussion	Discussed course topics, ideas, or concepts with other students outside of class?	2.5	3.2	+0.6
Skipped Class	Skipped class?	2.3	1.5	-0.8

Interpretation of Results of the Study

The data suggests that the game-dynamics framework was generally effective in increasing the academic engagement of the student-participants involved in this study. Of the 10 students, eight showed varying improvement (S#6, S#8, and S#10 S#1, S#2, S#3, S#4, and S#7), two showed no significant change (S#5 and S#9), and no student showed a decrease in engagement.

Each of the identified themes is a contributing factor to this overarching conclusion. The themes each correlate to a specific intervention, and, taken in aggregate, add up to a positive effect on overall student academic engagement. After examining the student questionnaires, it is clear that student behavior changed after implementation of the treatment. While it is reasonable to suggest that the implementation of a gamified

curriculum had a positive impact on student academic engagement, one cannot be absolutely sure that these changes were a result of the gamified curriculum.

Conclusion

Overall, the game-dynamics framework instituted in this research study had a positive effect on student academic engagement. The specific game dynamics used were Incremental Progression, Multiple Routes, and Psychosocial Moratorium. The majority of students demonstrated increased academic engagement after the introduction of these game dynamics. The researcher observed a great deal of evidence supporting this conclusion, which was supported by teacher-participant journaling and semi-structured interviews, as well as student pre- and post-questionnaires and semi-structured interviews.

CHAPTER FIVE: Discussion, Implications, and Recommendations

Problem of Practice

The PoP concerns the lack of academic engagement of 11th-grade students in an Algebra II class, evidenced by students not turning in assignments, falling asleep in class, and not participating in class discussions. The teacher-participant expressed a desire to improve her students' academic engagement. She was wondering what kind of impact the incorporation of gamification would have on student academic engagement.

Research Question

What impact will a gamification model of instruction have on the engagement level of 10 11th-grade students in a high-school Algebra II class?

Purpose Statement

The purpose of this Action Research project is to examine the impact of a gamification model of instruction on the engagement level of 11th-grade students in a high-school Algebra II class.

Introduction

One of the most important factors for academic success is student academic engagement, which Abbott (2014) defines as "the degree of attention, curiosity, interest, optimism, and passion that students show when they are learning or being taught, which extends to the level of motivation they have to learn and progress in their education"

(para. 1). There are many factors that influence academic engagement. Factors that have shown to increase academic engagement include student interaction with the subject matter, curiosity and opportunities for exploration, and authenticity or relevance to the real world.

The researcher noticed that these and other factors are present in many games, such as video games and board games. Students today are spending increasing amounts of time playing video games (Entertainment Software Association, 2014, 2017), so the researcher examined many video games to identify some commonalities in an attempt to apply these "game dynamics" (Hunicke et al., 2004) in an educational context, with the purpose of increasing student academic engagement. The three game dynamics that were identified were *Incremental Progression*, *Multiple Routes*, and *Psychosocial Moratorium*.

The *Incremental Progression* game dynamic can be defined as *the idea that people perform better if they are able to experience continual progression, no matter how small, towards a goal*. This game dynamic was applied to the classroom through the XP grading system, in which students were given experience points (XP) for completing assignments instead of grades. These points were simply a different presentation of the traditional total points system used in many courses, but the important part is that student XP totals never decreased.

The *Multiple Routes* game dynamic can be defined as *a system in which participants have multiple options in how to progress towards a final goal*. It built on the work of James Paul Gee (2007), who suggests that learners be given choice in assignments, allowing them to rely on their strengths, as well as allowing them to explore

alternatives. This game dynamic was applied to the classroom through the teacher-participant allowing students significant choice in the format of summative assessments.

The *Psychosocial Moratorium* (Gee, 2007) game dynamic can be defined as *a system in which the real-world consequences for failure are reduced, allowing participants the ability to "fail forward" and learn from their mistakes without worrying about the real-world consequences*. This was applied to the classroom through the teacher-participant allowing students to resubmit specific assignments multiple times, with only the highest score being recorded.

Summary of the Study

The researcher worked with a teacher-participant to incorporate a gamified curriculum into her Algebra II course in order to determine the effects on student academic engagement. He then collected data from the teacher-participant and 10 student-participants over the course of six weeks during the spring semester of the 2017-18 school year. The 10 student-participants were representative of the ethnic composition of the school's overall student population, and was composed of 8 females and two males.

Over the course of this study, the researcher collected several different data sets using a variety of instruments:

- Pre- and post-implementation Likert-scale student-participant questionnaire on academic engagement
- Pre- and post-implementation Likert-scale teacher-participant questionnaire on academic engagement
- Post-implementation semi-structured student-participant interviews

- Teacher-participant journaling
- Researcher observational journaling/field notes
- Student work samples

After collecting the data, the researcher followed best practices of action research to analyze the data and determine themes (Efron & Ravid, 2013), which were then organized and supported with evidence, following best practices of grounded theory (Glaser & Strauss, 1999). The researcher used triangulation to maintain reliability of conclusions.

Overall, the data shows that using a gamified curriculum had a positive effect on student academic engagement. Eight of the 10 student-participants showed varying levels of improvement in academic engagement, two of the student-participants showed no significant change, and no student showed a decrease in academic engagement. Each of the three game dynamics (Incremental Progression, Multiple Routes, and Psychosocial Moratorium) that were incorporated into the coursework show positive effects on student academic engagement.

Implications

With these findings in mind, the following section details implications of this study.

Transition to Total Points Grade Reporting

One of the main discoveries in this research project was that the majority of student-participants were more engaged by a grading system in which their overall points do not decrease. Considering it is very simple to change the way that grades are presented to students, it is recommended that teachers who are using a percentage-based grade-

reporting system to change to a total-points system, even if they do not wish to use the XP grading system that was used in this research study.

Incorporate Meaningful Student Choice

The student-participants in this study demonstrated much more academic engagement when they were allowed to make meaningful choices about how to demonstrate their learning. Students who, in the past, would simply choose the easiest way to complete an assignment instead chose more challenging options when they were offered choices that were meaningful. Therefore, incorporating meaningful choices in other learning activities would likely produce similar results, resulting in higher student academic engagement and achievement.

Encourage Productive Risk-Taking

Most student-participants in this study demonstrated the willingness to work hard, provided they are allowed to correct their mistakes. This demonstrates the positive effects of productive failure on academic engagement, as students were willing to learn from their mistakes and try again. This was only possible because the teacher-participant allowed them to submit specific assignments as many times as they liked, with only the highest grade being counted. This encouraged students to try multiple times, improving as they learned from their mistakes.

Therefore, students should be allowed to submit assignments multiple times, with only the highest score being recorded. This is similar to grading for mastery, and could be implemented relatively easily in many classrooms.

Action Plan

The researcher chose to complete this research in the hopes of improving student academic engagement, with the ultimate goal being increased student learning and academic outcomes. As he is moving to a different position as Instructional Technology Analyst and Designer for a college, the researcher will be sharing this work with other math teachers who could perhaps use it to improve their students' academic engagement. He will also work with school administrators to help educate them on the benefits that gamification could have for their students. He also plans on presenting the findings in various educational conferences and workshops.

Suggestions for Future Research

While the findings of this study are promising, the researcher will need to conduct further research in order to expand upon them. One way that he will expand the body of research on this topic is to conduct a similar study on a larger sample of students in order to obtain more reliable data. In addition, the sample will be random or purposive, in order to further reduce the effects of outliers.

Another area of further research will be to apply gamification to other types of students. Because the researcher will be working in the field of higher education, he will conduct a similar study with college students to determine the effects of gamification on their academic engagement.

Conclusion

Research has shown that one of the most important elements for learning is student academic engagement (Christenson et al., 2012; Conner & Pope, 2013; Gerber et al., 2013; Landis & Reschly, 2013; Tuominen-Soini & Salmela-Aro, 2014; Upadyaya &

Salmela-Aro, 2013; Weiss & García, 2015). Therefore, one of the most important things teachers can do to help their students learn is to work to improve their academic engagement. With this in mind, this research study demonstrates that incorporating a gamified curriculum model into classroom practice is one way that teachers can help students become more academically engaged, resulting in increased academic outcomes.

This research study focused on high-school students' academic engagement. The research question was designed to determine the effects of a gamified curriculum on the academic engagement of 10 high-school students in an Algebra II class. The participants included 10 11th-grade students in a single Algebra II class, as well as a teacher-participant who was the teacher of that class. There were eight female and two male student-participants, while the teacher-participant was female. During the research study, the teacher-participant incorporated three game dynamics into the classroom: Incremental Progression, Multiple Routes, and Psychosocial Moratorium.

Analysis of the data revealed three major themes: (a) the effects of Incremental Progression, (b) the effects of Multiple Routes, and (c) the effects of Psychosocial Moratorium. Each of these themes demonstrated a positive effect on student academic engagement. The researcher analyzed several data sets and used triangulation to increase reliability of conclusions. Overall, this study suggested that incorporating a gamified curriculum into classroom practice could have a positive effect on student academic engagement.

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Appendix A: Questionnaires

List of Questionnaire Links	
Questionnaire Name	Link
Student Pre-Implementation Questionnaire	https://goo.gl/forms/36u1SGXzdmz1slly1
Student Post-Implementation Questionnaire	https://goo.gl/forms/hwMWVjwd93XNUzEX2
Teacher Post-Implementation Questionnaire	https://goo.gl/forms/VpcQUo2I2VE1H9H23

Appendix B: Student Structured Interview Questions

1. What were your thoughts about the new XP grading system when you first heard about it? Why?
2. Have your thoughts about the new XP grading system changed? If so, how?
3. How has the new XP grading system affected your attitude towards schoolwork? Why?
4. Are you more or less likely to complete classwork with the new system compared to the old system? Why?
5. Do you think the new XP grading system should be used in your other classes? Why?
6. What were your thoughts about the "No Fail" assignments?
7. Do you feel that you put more or less effort into the "No Fail" assignments compared to other assignments? Why?
8. Do you believe it is helpful or harmful when you are given choices in your assignments, such as the logarithm video project? Why?
9. Do you feel that you put more or less effort into assignments in which you are given meaningful choice compared to other assignments? Why?

Appendix C: Teacher Structured Interview Questions

1. What are your overall thoughts about the gamified curriculum as it relates to student engagement in your classes?
2. Can you please describe what changes you made to your classroom instruction to incorporate a gamified curriculum?
3. What changes, if any, have you observed in student engagement since incorporating the gamified curriculum? What evidence do you have for this?
4. Do you plan on continuing to use a gamified curriculum in the future? Why or why not?
5. Do you have any other comments about the effects of a gamified curriculum on student engagement?