INTEGRATING GAMIFICATION INTO MATHEMATICS INSTRUCTION: A QUALITATIVE EXPLORATORY CASE STUDY ON THE PERCEPTIONS OF TEACHERS AT THE FOURTH AND FIFTH GRADE LEVEL

by

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WE, THE UNDERSIGNED MEMBERS OF THE COMMITTEE,

HAVE APPROVED THIS DISSERTATION

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OF WILLIAM HOWARD TAFT UNIVERSITY

COMMITTEE MEMBERS

Abstract

The purpose of this qualitative exploratory case study was to garner knowledge on how teachers perceive the effects of gamification on students' academic performance on mathematics standardized examination. Gamification is a developing pedagogy with limited studies exploring its effectiveness in the discipline of mathematics. The 2 research questions that guided this study were: How do 4th and 5th grade teachers perceive the effects of gamification on students' academic performance in mathematics standardized examinations? How do teachers perceive the implementation of gamification on students' success? This research was grounded in the theoretical framework of Piaget and Vygotsky's theory of constructivism as well as Skinner's theory of operant conditioning and Bandura's self-regulation theory. There is inadequate knowledge on how teachers perceive the effects of gamification on students' academic performance on mathematics standardized examination.

The participants were 4th and 5th grade teachers at the elementary level. Data were collected with the use of individual interviews, field notes, and assessment data. A questionnaire was used to select purposefully participants. The responses to the semiopen-ended questions from the interview were recorded, transcribed, and analyzed using line-by-line coding technique. This led to the emergence of 6 themes surrounding significant statements made by the participants. These themes include attitude, perception, learning outcomes, instructional practices, and professional support. The findings highlighted the essence of the shared perceptions of the study participants.

Keywords: *avatars, badges,* behaviorism, constructivism, gamification, Kahoot, *leaderboards,* Mathematics, p*oints,* Quizziz, and standardized testing

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Chapter One

Introduction

Overview

Arsevens (2015) and Mefor (2014) stated that the world today is extremely mathematical; hence modern citizens cannot afford to be ignorant of it. Arsevens also mentioned that in the 21st century, teachers are expected to teach mathematics with the aim of having students create effective solutions. In addition, Mefor also cited that these solutions should be applicable to real problems; hence, individuals can use mathematics effectively in their daily lives. In a similar vein, Acharya (2017) posited that mathematics is one of the most important subjects in our modern lives. Without the knowledge of mathematics, it may be difficult to progress in today's global society.

Dooley et al. (2014) asserted that mathematics can be perceived as a valuable perspective for visualizing and shaping the world. The authors suggested that these are not the only attributes and mathematics should also be perceived as inventive and deserving of interest in its own particular right. The importance of mathematics in today's world has led different levels of education to place significant emphasis on effective mathematics instruction. Students today have demonstrated and expressed their dislike for mathematics despite being aware of its significance.

In addition, Romero (2014) agreed that math is perceived as a distasteful subject for many people. Mathematics has been characterized as a tedious subject to learn as well as to teach. Sa'ad, Adamu, and Sadiq (2014) found that poor performance in mathematics can be attributed to students being fearful of the subject. Gafoor and Kurukkan (2015) agreed that many students are of the view that the subject is boring and expressed that

they find it difficult to remember and understand formulas. Brandt, Bassoi, and Baccon (2016) likewise Bertini and Passos (2016) and Prieto (2016) concurred that many educators encounter difficulties with their students' inability to understand and demonstrate the use of the basic operations in both simple and complex problems. Mutodi and Ngirande (2014) postulated that teachers should strive to understand the fear and challenges that are associated with mathematics and implement teaching and learning strategies so that students can overcome their fear and challenges.

According to Dooley et al. (2014), every learner has the potential to solve mathematical problems and transfer his or her knowledge and skills to making a connection with the world. This change in perception requires modification in instruction as well as making specific instructional connections with mathematics. The demand for change in pedagogy requires new methodologies to improve mathematics instruction; therefore, it is essential to try new techniques. One of the most recent methodologies in education is the use of gamification to improve students' motivation and academic performance.

According Kim (2015), gamification is the integration of game components into nongame applications or spaces, such as frameworks or spaces. This is done with a view to gamify things. Kingsley and Grabner-Hagen (2015) identified examples of these game-like components, such as leaderboards, badges, and quests (assignments), which are usually used in a classroom setting. Mtitu (2014) concurred that for instructions to be effective and efficient, learner-centered methods must be applied. These methods necessitate that teachers actively involve students in the teaching and learning process. Authors are calling for more research to be done on gamification, specifically in the area

of student learning habits and motivation in mathematics (Dichev & Dicheva, 2017; Geelan et al., 2015).

This research investigated teachers' perception on the effects of gamification on fourth and fifth grade students' success and academic performance on mathematics standardized examinations. Kim (2015) posited that gamification is a developing pedagogical tool that can be used to facilitate learning and heightened motivation using components of games, methods, and game-based thinking. Kim noted that when using gamification, students are engaged in activities that entail components of games where they overcome a challenge; earn points or badges for completing a task. On the other hand, the use of the term gamification does not restrict students to feel things are a game in order to engage in learning. Goeller (2018) agreed that for students to learn and be successful, motivation, engagement, attention, interest, effort, enthusiasm, participation, and involvement are some important attributes that must be impacted. The use of gamification is a pedagogical tool that has the potential to evoke and impact the attributes suggested by Goeller (2018). These, Goeller believed, are necessary for learning to occur. This qualitative exploratory case study explored teachers' perception of gamification on students' success as well as students' academic performance on mathematics standardized exams. According to Yin (2014) and Patton (2015), a case study research may be misinterpreted for a phenomenological research. Yin (2014) and Patton (2015) theorized that the choice of approach depends on the researcher's philosophical interest. Yin (2014) and Patton (2015) believed that if the study focusses on events, programs, and environmental factors, the researcher has produced a case study as opposed to a phenomenological research.

A case study design was selected for this research because the researcher used multiple methods to collect the data as opposed to a phenomenological study, which would require an interview to be the main method of data collection. Field notes and assessment data in the form of pretest and posttest data were collected as opposed to a phenomenological study, which would involve observations, journals, art, poetry, music, and other forms of art (Patton, 2015; Yin 2014).

Background

Mathematics is a unique discipline that promotes and facilitates critical thinking among its learners. Mathematics has been at the core of ancient civilizations, dating as far back as the ancient Greeks and Roman empires. Today, mathematics is equally valued and continues to form the foundation for many other disciplines. Ernest (2015) believed that mathematics is useful in developing intellect and consistency of thoughts and ideas. In referencing these skills, Ernest further posited that these attributes lay the foundation for learners to develop the necessary aptitudes to engage and make sense of the world around them. Ernest (2015) also concurred that mathematics provides a method for correspondence that is current, concise, and unequivocal. Ayllón, Gómez, and Ballesta-Claver (2016) as well as Leikin and Pitta-Pantazi (2013) asserted mathematics helps to stimulate inventiveness and creative ability in the teaching-learning process. This inventiveness and creative ability extend to learners engaging in meaningful learning construction and problem solving (Ayllón et al., 2016; Leikin & Pitta-Pantazi; 2013). Gafoor and Kurukkan (2015) posited that everybody needs numerical ideas in order to assume a mindful part in an equitable society.

Teaching at an elementary school in the state of North Carolina for the school year 2015–2016, this researcher discovered that the students were lacking basic mathematical concepts and skills, as well as the motivation required to progress and excel in the area of mathematics. Evidence of this was demonstrated through the students becoming dependent on counting fingers, using multiplication charts, and using calculators for basic math facts. The result faced was their poor performance in math. Lord (2017) agreed that there is an achievement gap in mathematics in the state of North Carolina, which is a cause for concern.

Lord (2017) concurred that recent data revealed that numerous elementary schools in North Carolina have failed to make improvement and do not meet the national average performance in mathematics. It was noticeable that the underperformance of students in mathematics on standardized exams was a concern for many stakeholders in Davis County School (pseudonym) for the past three years that the researcher has been working there. Lord (2017) posited that for students to meet proficiency standards in mathematics on the North Carolina end-of-grade exams, considerable changes need to be made to the way teachers deliver instruction and prepare students for high-stakes standardized testing.

Freeman et al. (2014) reported that the use of lectures and other traditional learning methods have resulted in students being unsuccessful 1.5 more times as opposed to the use of active learning methods. DuFour and Fullan (2013) found that exposure to effective instructional strategies and practices results in improved student achievement and shows consistent gains over time.

For the school year 2016–2017, teachers in the county were encouraged to engage actively students through the use of digital technology. Hence, system-wide professional

development sessions were conducted on active engagement strategies and tools. Therefore, more emphasis was placed on teachers using digital technologies as pedagogical tools in their instruction. These digital tools allowed teachers to gamify their instruction with the objective of improving students' academic performance. The effects of this implementation on students' academic performance in mathematics has not been investigated. The integration of elements in a video game in to a traditional class setting is a growing movement in education called Gamification or Gamified Learning. Simply defined, gamification involves utilizing game design components in nongame situations (Erenli, 2013). For decades, retailers have used these techniques in order to manipulate behavior with rewards cards, frequent flyer miles, and discount days.

In their study, C.-M. Hung, Huang, and Hwang (2014) made a recommendation for more research to be done on gamification in mathematics, as most mathematical games fail to engage students in solving real-world problems using their mathematical understanding. According to Katmada, Mavridis, and Tsiatsos (2014), gamification is believed to motivate students, but further investigation is needed to prove its effects on the academic performance of students in the subject of mathematics. Geelan et al. (2015) also suggested that further research is necessary to prove the effectiveness of gamification on meeting the needs of students as well as maximizing learning outcomes. The achievement gap in mathematics and the implementation of gamification in instruction coupled with the recommendations highlighted by the aforementioned researchers motivated the investigation of this study.

Statement of the Problem

It is unknown how teachers perceive the effects of gamification on students' academic performance on mathematics standardized exams at the fourth and fifth grade levels. In addition to the teachers' perceptions relating to the academics, it is also unknown how teachers perceive the implementation of gamification on students' success. Although many researchers such as Kim (2015); Freeman et al. (2014); Laursen, Hassi, and Hough (2014); and Bressoud and Rasmussen (2015) perceived that gamification could be valuable in education, research on teachers' perception of gamification on student achievement in mathematics as well as students' success is deficient. The aim of this study is to explore teachers' perception of gamification on students' success as well as students' academic performance on mathematics standardized exams. DuFour and Fullan (2013) and Lord (2017) stated that for students to be successful and achieve proficiency in mathematics, effective motivational teaching strategies must be employed. The literature on active engagement reveals extensive evidence on the critical impact of motivation on academic achievement (DuFour & Fullan, 2013; Freeman et al., 2014).

Gamification is a recent pedagogical tool that has been used to motivate students, but its effectiveness on students' nonacademic success as well as students' academic performance in mathematics has not been fully explored. Researchers, such as C.-M. Hung et al. (2014), Katmada et al. (2014), and Geelan et al. (2015), have used gamification in their mathematics instruction to promote active engagement and suggested students were motivated, but further research is needed to prove its effectiveness on students' nonacademic success and their learning outcomes. Halsey

(2015) suggested that more research needs to be done to determine what impact gamification can make in the classroom.

Dichev and Dicheva (2017) posited that numerous studies have been conducted on gamification as an advancement in education. Based on their study, they recommended that more methodically defined examinations as well as thoroughly verified methods should be conducted to confirm the educational benefits of gamification. Dichev and Dicheva (2017) also suggested that in order for gamification to become an accredited pedagogical tool, rigorous testing approaches must be applied.

Purpose of the Study

The purpose of this qualitative exploratory case study was to explore teachers' perception of gamification on students' academic performance on mathematics standardized exams at the fourth and fifth grade levels in North Carolina. A second objective of this research was to gain an in-depth understanding on how teachers perceive the implementation of gamification on students' success. In addition to analyzing the teachers' perceptions, a comparison of students' assessment data in the form of pretest and posttest scores was done to authenticate the perceptions of these teachers. To participate in this study, these teachers were required to have at least three years' teaching experience. They were also required to have at least one year's experience with using gamification in mathematics instruction.

This study was motivated by researchers such as C,-M. Hung et al. (2014), Katmada et al. (2014), Dichev and Dicheva (2017), and Geelan et al. (2015) who suggested that further research is needed on the effectiveness of gamification on students' success and academic performance in mathematics.

Insights gained from this study may provide opportunities for those interested in using gamification in their instructional practices to meet the needs of their students. Investigating the perceptions of experienced educators will contribute to the developing knowledge of this new technique. District officials and educators will also be provided with the insights on the process and manner in which this tool may impact students' academic performance in mathematics. These stakeholders will then be able to make informed decisions about the use of this pedagogical tool for their institutions.

This qualitative exploratory case study examined the effectiveness of gamification on students' success as well as on their academic performance at the fourth and fifth grade levels at two elementary schools in North Carolina. A total of 12 teachers were interviewed to get their perceptions on the implementation and effectiveness of gamification on students' success and academic performance in mathematics. Field notes were collected during the interview, which were later transcribed and analyzed. Assessment data in the form of pretest and posttest were collected and the researcher compared and analyzed the data to validate and authenticate the information obtained from the interview.

A qualitative research method was best suited for this study because the objective was to explore a social or human problem (Creswell, 2013). This provided an extensive understanding within a bounded system in order to have a clear and holistic understanding of the research problems (Baškarada, 2014; Yin, 2014). A qualitative exploratory case study was necessary, as it provided detailed account of the related facts relating to the case setting, collating of extensive material from various sources to

provide an in-depth picture of the case, and using the researcher as an instrument of data collection (Creswell, 2013).

Research Questions

In any research, it is necessary to have a clear goal of the questions that the research seeks to answer. This is important as it serves as a guide to the researcher as to whether the research is meeting the objective it sets out to accomplish. It also serves as an evaluative tool for the researcher as well as other individuals. Creswell (2014) and Christensen, Johnson, and Turner (2014) stated that it is important to define the research questions because it narrows the purpose and objective of the research down to the specific areas the study will address. In a similar vein, Martindale and Taylor (2014) asserted that reasonable research questions lay the foundation for the development of the research purpose and objective, enabling it to be clear; these are inseparably connected.

Qualitative research questions were selected because they are flexible, adaptable, and nondirectional (Creswell 2013). Conforming to Creswell (2013), the aim of qualitative research questions was to determine or discover the practice, or describe the experiences studied. These questions aim to articulate what the researcher wants to know about the intentions and perspectives of those involved in the process. Qualitative questions were most appropriate for this study as they allowed the participants to share information with the researcher. In addition, they were designed to use neutral exploratory language that does not convey conclusions that the researcher expects. The research questions that guided this study are:

1. How do teachers perceive the effects of gamification on fourth and fifth grade students' academic performance on mathematics standardized examinations?

2. How do teachers perceive the implementation of gamification on students' success?

Significance of the Study

Although gamification has been extensively researched since its introduction in education in the early 2000 (Marczewski, 2013; Melwin, Merry, & Chiramel, 2017) limited research has been conducted on its impact on students' academic performance in mathematics (Dichev & Dicheva, 2017; Geelan et al., 2015). Researchers such as Christy and Fox (2014), deByl (2013), and Jones (2015) have investigated its effectiveness on students' motivation. However, they failed to address adequately how teachers perceive its impact on students' academic performance, specifically in mathematics.

This study is significant because it contributes to the limited qualitative data existing on teachers' perception of gamification's impact on students' academic performance in mathematics standardized examination at the fourth and fifth grade levels. Biro (2014) theorized that gamification as a learning theory is supported by the ideas of constructivism and behaviorism. Constructivism is an active learning theory in which the learner creates new knowledge from previous experiences and understanding (Bada, 2015). This approach allows students to rely heavily on their initiative as well as learn at their own pace.

On the other hand, behaviorism, as defined by Pritchard (2014) is a learning theory that concentrates only on objective observable behaviors and disregards all liberated activities. This theory presumed that human behavior is predictable. The behaviorist approach focuses on outcomes, dependent upon manifested behavior and repeated reinforcement of responses. Biro (2014) believed that the correlation between

gamification and these two theories have the potential to cater to the diverse needs of students within a single classroom setting. Results from each research question will be useful for researchers who will conduct further study to improve the use of gamification in education and mathematics instruction.

This study seeks to make significant contributions to further understanding of how gamification as an active engagement tool contributes to motivation and students' academic performance in mathematics. Phillips (2015) and Wang and Eccles (2013) suggested that active engagement is one of the major predictors of academic success. Pitre (2014) found that teachers, who used effective, engaging instructional strategies, promoted learning environments that affected the level of academic progress their students achieved. Freeman et al. (2014) reported that the use of lectures and other traditional learning method are monotonous, and resulted in students being unsuccessful 1.5 more times, as opposed to the use of active learning methods. This study provides an opportunity for educators to be privy to research-based strategies that can actively engage students and improve their mathematics performance on standardized exams. They will be able to utilize effectively these strategies to complement their instructional objectives in mathematics. They will then have produced well-rounded and educated students who arrived at their level of learning based on the exposure to and the ability to utilize the strategies taught, to explore further the world of mathematical knowledge.

Definition of Key Terms

Creswell (2013) cited that in order to explain the dialect utilized all through the study, the researcher may give explicit meanings of specialized technical terms used in the scope of the study. The accompanying terms are utilized throughout the study.

Providing an explanation of the meaning of these terms in the context of the study is necessary. With the end goal of clarity, the accompanying terms utilized as a part of the investigation are defined, here.

Avatars: Avatars, as defined by Werbach and Hunter (2015), are pictorial symbols of players in a gamified setting.

Badges: Werbach and Hunter (2015) cited that badges are visual representations of achievements that can be acquired and presented in a gamified setting. Badges are used to provide clarity of players' level of achievement or goal. Anderson, Huttenlocher, Kleinberg, and Leskovec (2013) stated badges are used to represent the players' merits.

Behaviorism: Pritchard (2014) defined behaviorism as a learning theory that concentrates only on objective observable behaviors and disregard all liberated activities. This approach emphasized that learning is dependent on environmental conditions.

Constructivism: Bada (2015) defined constructivism as an active learning theory in which the learner creates new knowledge from previous experiences and understanding.

Gamification: According Kim (2015), gamification is the integration of game components into nongame applications or spaces, such as frameworks or spaces. This is done with a view to gamify things. Kingsley and Grabner-Hagen (2015) identified examples of these game-like components as leaderboards, badges, and quests (assignments), which are usually used in a classroom setting.

Kahoot: Kahoot is a free game-based learning platform with characteristics such as avatar, leaderboard, memes, music, points, and themes. The leader of the game is responsible for selecting and initiating the quiz. A game code is provided for players to

input after they have searched their browsers for https://kahoot.it. It can also be played using a smartphone or tablet. The structure of the game allows the players to interact socially with the teacher as well as their peers by frequently looking up from their devices.

Leaderboards: Costa, Wehbe, Robb, and Nacke (2013) measured players against specific standard of success and classified them according to their comparative success. Codish and Ravid (2014) defined leaderboards as comparative feedback that visually represent a player's ranking within a game.

Mathematics: Acharya (2017) defined mathematics as a body of knowledge in the area of science and technology. Harris (2015) defined mathematics as the science of reasoning and computation.

Points: Werbach and Hunter (2015) stated that points are numerical representation of a player's progress in a gamified setting.

Quizziz: Quizziz is an alternative to Kahoot, but they share some similarities. Some of the characteristics of Quizziz include avatars, leaderboard, memes, music, and themes. The leader of the game is responsible for selecting and initiating the quiz. A game code is provided for players to input after they have searched their browsers for join.quizzizz.com. It can also be played using a smartphone or tablet.

Standardized Testing: Kaukab and Mehrunnisa (2016) defined a standardized test as a form of test that is standard scoring of all the candidates who are required to take the test is consistent. All the questions on the test are the same and the candidates are required to be given the same amount of time.

Delimitations

Simon and Goes (2013) defined delimitations as controllable factors that may influence a study. They believed that the delimitation describes the latitude of the study or controls the boundaries or restrictions of the study. The researcher conducted an in-depth interview instead of questionnaire method. A questionnaire may limit the participants' responses as opposed to them expressing first-hand knowledge of the use of gamification in mathematics and the results they received. Conforming to Simon and Goes (2013), the aforementioned are the major features that restrict and delimit the parameters of this study, as they were within the researcher's control.

Limitations

Simon and Goes (2013) defined limitations as external uncontrollable factors that may restrain or influence the outcome of the study. The findings of this study may be limited to the population within the geographical area where the study was conducted. Generalization of the findings of this study may not be appropriate but may only be specific to population from which the sample was be selected. The methods used to collect the data allowed for a qualitative analysis rather than quantitative analysis.

Assumptions

One component of any research design is assumptions. Leedy and Ormrod (2016) posited that research problems could not exist without assumptions, as they are rudimentary. Simon and Goes (2013) concurred that assumptions allow research to be conducted. Validating the responses of each participants will require substantial amount of time and effort. It is assumed that factual, honest, and reflective responses will be received from the interview and pretest and posttest data. To garner this success,

participants were assured that their responses would be kept confidential. The institutions were assured that they would be referred to using pseudonyms.

Nature of the Study

This research was primarily a qualitative exploratory case study. The motivation behind such contextual investigations was to give a thoughtful, comprehensive portrayal and analysis of a single, limited unit arranged in a particular setting to give knowledge into genuine circumstances (Merriam & Tisdell, 2016; Pickard, 2013). Case study was most appropriate for this study because case studies are ideal for discovering first-hand procedures or activities or ones that are inadequately understood. Case-study approach also provides better prospects for a universal understanding of the procedure. This study also provided detailed account of the facts relating to the case setting, collating of extensive material from various sources to provide an in-depth picture of the case, and using the researcher as an instrument of data collection (Creswell, 2013).

This case study aimed at providing detailed information on the methods that enabled the researcher to examine the teachers' perspectives from various stand points in relation to each other. Case study was also suited for this study as it was done by visualizing the topic within its total environment. Merriam and Tisdell (2016) suggested that exploratory case study examines diverse phenomena which are often defined by inadequate comprehensive primary investigation, specifically articulated assumptions that can be verified, and/or by a specific research setting that restricts the choice of methodology. Conforming to Merriam and Tisdell (2016) explanatory cases are appropriate for conducting causal investigations. Merriam and Tisdell asserted that the

researcher should aim to provide contending clarifications for similar procedures and specify how these clarifications may be applicable in other settings.

Yin (2014) asserted that the explanatory case-study research approach aims at answering research questions how and why because they are associated with practical relations that can be portrayed over time as opposed to being simple occurrences or prevalence. On the contrary, Yin (2014) theorized that research questions that are geared toward answering when and what are considered exploratory in nature. According to Yin (2014) and Patton (2015), a case-study research may be misinterpreted for a phenomenological research. Yin (2014) and Patton (2015) theorized that the choice of approach depends on the researcher's philosophical interest. Yin (2014) and Patton (2015) believed that if the study focusses on events, programs, and environmental factors, the researcher has produced a case study as opposed to a phenomenological research. The objective of this exploratory case study was in accordance with Yin's view, which is to define questions and hypotheses of a succeeding study and to determine the viability of the desired research procedures.

Yin (2014) asserted that an exploratory case study allows researchers to utilize interviews and pretest and posttest data in exploring and examining instructional practices and perceptions. Although the teachers were purposefully selected, they were assured that their participation was voluntary. Purposeful sampling was appropriate for this study as these participants had first-hand experience of the use of gamification in mathematics instructions. Yin (2014) stated that purposeful sampling usually produces detailed explanations from participants. A qualitative approach was used to gather information about participants' thoughts and feelings on a topic representing the

participants' point of view. This case study provided a more comprehensive study of the problem and provided more detailed description of the instructional practices used at these institutions. The use of this method allowed the researcher to have a thorough understanding of the experiences and perceptions of individuals in the field. The data for this study were collected through the use of interviews, field notes, and assessment data. The data were analyzed using triangulation as a means of reinforcing validity of the study (Yin, 2014).

A qualitative explanatory case-study approach was utilized for this study, as the researcher was able to garner more comprehensive and perceptual data from the participants. This offered more extensive understanding within this restricted structure (Yin, 2014). Merriam and Tisdell (2016) asserted that the use of a qualitative explanatory case study provided the researcher with a better opportunity to discover the situation from numerous standpoints and gain further understanding of the problem. A qualitative exploratory case study was best suited for this study, as the method of data collection allowed the researcher to have an in-depth understanding of the participants' perceptions of gamification as opposed to mere numerical data. Yin (2014) offered that a quantitative case study is an organized procedure that focuses on specific problems and uses numerical data to explain and scrutinize connections among variables.

Dissertation Structure

The first chapter offered the study introduction, discussing the purpose of conducting the investigation. The study's contextual framework as well as its key assumptions, delimitation, and limitations were described. The research questions that guided the research were discussed.

The second chapter covers a review of the existing literature on gamification on mathematics instruction. It further defines the parameters of the study and also aims to produce its contextual framework. Additionally, it also highlights significant points on gamification on mathematics instruction.

The third chapter provides insight related to the methodology of the study's design and procedures. It also explains the protocols for data collection as well as the techniques that were used to investigate and evaluate the data in the gamified course.

The fourth chapter explains the findings of the study in addressing each of the research questions. It also provides the factual findings on the effectiveness of gamification in enhancing mathematics instruction at the fourth and fifth grade levels in Davis County District (pseudonym).

The fifth chapter concludes the study with a discussion and recommendations for further research on the effectiveness of the gamification components in mathematics. It also validates the relationship between the results and the contention of the investigation. Therefore, it presents interpretation of the findings.

Summary

This chapter provides an overview, background of the study, statement of the problem, the purpose of this study, the significance of the study, definition of key terms, limitations, delimitation, and assumptions related to the study. Mathematics learning is of utmost importance for students at the elementary level. Additionally, it is important to note that elements of gamification are emerging strategies that may be implemented in the educational arena as a hopeful means to empower, engage, and motivate students to improve their performances. The research on gamification, particularly in mathematics, is

limited. This research provided deeper understanding of teachers' perception on the effects of gamification on fourth and fifth grade students' academic performance on mathematics standardized examination. In addition, the researcher examined teachers' perception on the implementation of gamification on students' success.

Chapter Two

Review of Literature

Overview

Mathematics learning is of utmost importance for students at the elementary level. H. R. Chen, Liao, and Chang (2015) asserted that mathematics is a phenomenon that humankind has used directly or indirectly since ancient times. From the simplest of daily life situations to the most complicated problems, solutions have always been found. The authors maintained that in mathematics curriculum, it is deemed important to train individuals, so they can use mathematics in daily life, resolve problems, share their resolutions and thoughts, take part in teamwork, be confident in mathematics, and develop a positive attitude toward mathematics. However, the learning of mathematical concepts presents numerous difficulties for many students.

Romero (2014) suggested that mathematics is often perceived as a challenging and boring subject for students to grasp. Many have associated this perception of mathematics being boring with traditional methods of teaching, which are also perceived as being ineffective (Dicheva, Dichev, Agre, & Angelova, 2015). Jayasinghe and Dharmaratne (2013) suggested that traditional methods of teaching are no longer beneficial to students, as they do not facilitate critical thinking in students. Jayasinghe and Dharmaratne believed that traditional teaching methods allow students to concentrate on exams rather than allowing students to garner deeper understanding of the concepts being taught.

There are many different methods that educators use to engage actively students and help them to become numerically literate. One such method is the use of gamification

as an instructional tool to support those who struggle in understanding mathematical concepts. Jagušt, Boticki, Mornar, and So (2017) suggested that the use of gamification has significantly contributed to student motivation and mathematical achievement in problem solving. Similarly, Chin, and Zakaria, (2015) stated that games have been successful in improving students' number concepts and number operations skills; while Kiili, Devlin, and Multisilta (2015) found that games have a significant impact on students' critical-thinking skills and problem-solving skills. On the other hand, there are no prescriptive guidelines for using games as a valuable theoretical tool in the teaching and learning of specific content to specific learners. This stems from the inadequacy of rigorous research investigating the effects of game-based learning on math skills development. For the purpose of this research, this literature review analyzes the theories behind the effective use of gamification as an instructional tool on the academic performance of students on mathematics standardized examination at the fourth and fifth grade levels.

Theoretical Framework

The use of gamification in education to enhance learning is supported by the ideas of constructivism and behaviorism. Bada (2015) defined constructivism as an active learning theory in which the learner creates new knowledge from previous experiences and understanding. Jean Piaget and Lev Vygotsky are renowned theorists in the development of constructivism. Piaget and Vygotsky believed that constructivism is important in education; however, their views differ in how it should be done. Piaget (1950) believed that learning is an active process as opposed to being passive. Piaget's perspective of a constructivist classroom is one in which children are provided with

different activities to discover new ideas and construct meaningful knowledge. On the contrary, Vygotsky (1978) was of the view that a constructivist classroom should reflect learning through social interaction. Both theorists agreed that learning involves active participation and collaboration of diverse learners.

The use of gamification as a pedagogical tool broadens the benefits of constructivism in the teaching and learning process. Piaget (1962) and Vygotsky (1978) believed that children acquire knowledge through games. Gamification in education paints a vivid picture of the old adage tell me, and I will forget, how me, and I may remember, involve me, and I will understand. Werbach (2014) posited that gamification involves the utilization of game thinking as well as the components of games in engaging participants in problem-solving activities.

The constructivist approach proposed by Pagiet (1950) is aligned with the objective of gamification. The constructivist approach and the application of gamification in education create an opportunity for students to be engrossed in meaningful inquiry to learn new materials. This act of inquiry motivates students to solve problems and construct knowledge on their own. In Vygotsky's view of social constructivism, gamification allows students to construct their own knowledge while they interact and learn cooperatively (Miltenoff, Martinova, & Todorova, 2015). A typical example of gamification according to Vygotsky's social constructivist theory is where students participate in a collaborative, competitive environment to solve a problem that requires construction of new knowledge.

Piaget's (1950) and Vygotsky's (1978) theories of constructivism have strongly influenced the basis of this study, as gamification allows students to learn through a

cognitive and socio-cultural interaction in a rich and realistic learning environment. In gamification, the teacher acts as a facilitator of knowledge as opposed to being the main source of knowledge. In a gamified classroom setting, students have to analyze the information they perceive, develop new skills in order to collaborate, and compete with other students.

In contrast to constructivism, there is the behaviorist theory. This theory has also supported the use of gamification in education. Bandura's (1992) theory of self-regulation and Skinner's (1938) theory of operant conditioning are the behavior premise of this research. According to Skinner (1938), human minds can be treated as a black box. Hence, students can be coerced to learn through conditioning and reinforcement. In a gamified environment, students are compelled to succeed (in essence learn) in the pursuit of being rewarded. In a gamified setting, student may become dependent on the rewards. Chou (2015) suggested that to maintain high behavior rates, rewards should be done on an intermittent basis in order to eliminate it from becoming a plateau.

Eminent theorist of behaviorism Bandura (1992) and proponents of educational games Jackson and McNamara (2013) believed that the reward structure of gamification is a method of propelling students to make advancement toward learning. Hamlen (2013) and Hammer, Roberts, Lowry, Gaskin, and Twyman (2013) agreed that these rewards motivate students to succeed, which allows them to continue playing in a cyclical process. Tamim and Grant (2013) asserted that motivation involves the construction of interest and scenarios in which students are engaged in desirous activities.

Bandura's (1986) principle of self-regulation epitomized students' ability to succeed in a gamified environment (Erhel & Jamet, 2013). In a gamified classroom,

students should engage in self-observation where they analyze the gamified environment. Students also set goals and track their progress as well as the influence of their particular actions. The final stage in self-regulation is self-judgement. At this stage, students use their personal standard to evaluate their current performance, comparing it with other students' performance. Self-regulation allows students to set new goals and establish new strategies in a gamified environment (L. X. Chen & Sun, 2016). The associations of gamification with the theories mentioned are adequate and extensive to formulating its own study. This laid the foundation for this study in which students must be actively engaged in order to be motivated in constructing their own knowledge in a social environment.

History of Standardized Testing

Kaukab and Mehrunnisa (2016) determined that standardized testing began in China. Citizens in China were required pass an examination to evaluate their knowledge of Confucian philosophy and poetry in order to obtain a government job. Huddleston and Rockwell (2015), as well as Lieberth (2016) and Kaukab and Mehrunnisa (2016), asserted that in 1905, a French psychologist named Alfred Binet was the inventor of the concept now known as standardized testing. Cherry (2018) posited that Binet initiated an intelligence test that was later expounded upon by Standford, which became known as the Stanford-Binet Intelligence Test.

According to Maranto (2015), the first standardized test was designed and administered in 1845 in Boston Public Schools by Horace Mann. Huddleston and Rockwell (2015), as well as Lieberth (2016) and Kaukab and Mehrunnisa (2016), postulated the introduction of standardized testing provided an opportunity for objective

testing where the results would be equitable. This resulted in the review of the quality of teaching and learning in urban schools and helped to give a comparison of the schools and the teachers. The approach was successful and as a result, a written test was introduced and implemented across the United States. As an example, it also laid the foundation for New York Regents Exams in 1865 (Huddleston & Rockwell, 2015; Kaukab & Mehrunnisa, 2016; Lieberth, 2016; Maranto, 2015).

Alcocer (2017) theorized that the idea of establishing a formal assessment of student achievement by American educators emerged in 1838. In 1840 to 1875, oral examinations were replaced by formal written testing. According to Alcocer (2017), during the Pre-Civil War era, external mandated written exams were used in schools to evaluate students' progress. This was done in specific curriculum content areas and helped to shape various administrative and policy decisions by educational management. The expansion and governance of new testing instruments emerged in1875 and lasted to the end of World War I (Huddleston & Rockwell, 2015; Kaukab & Mehrunnisa, 2016; Lieberth, 2016). Alcocer (2017) theorized that measurement of mental ability as well as the evaluating of students' preparation for college emerged from this development. As a result, there arose several issues relating to testing, as well as some general goals in American education system (Alcocer, 2017).

Charles William Eliot was the president of Harvard in 1890. In that capacity, he made the recommendation that a structured method of common entrance acceptance be put in place. This, he believed, would epitomize a standard for all schools and colleges across the country instead of separate testing at each school. Alcocer (2017) and Maranto (2015) reported that in 1901, the College Entrance Examination Board emerged, and

students were tested for the first time in nine different subjects across the country. Between 1900 and 1932, more achievement tests came into existence. According to Alcocer (2017) and Maranto (2015) there were as many as 1,300 achievement tests and up to 400 tests of mental capacities. It was further noted that tests were developed in areas such as assessments of athletic ability, vocational tests, 92 high school tests, and an assortment of different tests were produced to enhance the intelligence tests. Therefore, statewide testing programs became more prevalent (Kaukab & Mehrunnisa, 2016).

Alcocer (2017) and Maranto (2015) further noted that between the years 1908 and 1916, standardized tests were developed in arithmetic, drawing, hand writing, reading, spelling, and language ability by Edward Thorndike and his students at Columbia University. Comprehensive examinations were also developed in six subject areas by the College Board in 1916. These involved performance assessments, which required expository as well as composition writing and sight interpretation of different languages. Huddleston and Rockwell (2015), as well as Lieberth (2016) and Kaukab and Mehrunnisa (2016), reported that the Standford-Binet test was administered to 6,500 students in 1917 and 1918. This test was administered with the inclusion of objective-type questions known as multiple-choice items formulated by Arthur Otis. The American Psychological Association recruited Lewis Terman, along with others in 1917, to assist the Army in developing group intelligence tests as well as a group intelligence scale. Alcocer (2017) and Maranto (2015) postulated that the existence of Army testing during World War I paved the way for the increase in school testing movement. This laid the foundation for the establishment of more than 100 standardized tests by 1918. These were

established by various scholars to evaluate the performance of elementary and secondary schools in various subject areas (Alcocer, 2017).

According to Alcocer (2017), nearly half a million tests were published in the fall of 1920 by the World Book. In 1925, a survey from the United States Bureau of Education suggested there was an increase in classifying students by intelligence and achievement tests. Alcocer (2017) and Maranto (2015) indicated that the first Scholastic Aptitude Test was founded by the College Board and was administered in 1926. It was formatted so that the test had a duration of 90 minutes, consisting of 315 questions. The questions covered basic math, vocabulary knowledge, and initial repetition of fill-in-the-blank analogies. Expansion of the test by 1930 led to the oral and math test being distinct from each other. The first major statewide testing program was initiated by the University of Iowa. This was done under the direction of E. F. Lindquist, professor of education at the University of Iowa. This program was specifically for high school students (Alcocer, 2017; Maranto, 2015).

Alcocer (2017) reported that multiple-choice tests were fully implemented in schools by 1930. Maranto (2015) and Alcocer (2017) averred that the increasing popularity of multiple-choice questions led to testing being criticized for encouraging rote learning and guessing of content as opposed to promoting higher-order thinking. These critics were unsuccessful in their protest, as the main objective of the testing was to achieve efficiency and objectivity.

According to Huddleston and Rockwell (2015), likewise Lieberth (2016) and Kaukab and Mehrunnisa (2016), the Army Alpha and Beta aptitude tests, which were later renamed as Army Mental Tests, were developed by Robert Yerkes. The Army

Alpha test was developed for evaluating prospective soldiers who could read and write while Army Beta test was used for those who were illiterate (Huddleston & Rockwell, 2015; Lieberth, 2016; Kaukab & Mehrunnisa, 2016). Both tests were used for evaluating prospective soldiers during World War I. Kaukab and Mehrunnisa (2016) posited that these tests were marked manually and took extended periods of time to mark. Alcocer (2017) theorized that this led to the development of the IBM 805 computer as an automatic test scanner, in 1936. The development of the computer led to the introduction of the bubbling answers technique. A change was made to this development in 2005, when a writing section was added.

Alcocer (2017) cited that schools outside of the United Stated were privy to the Iowa tests by the late 1930s. Scoring of tests and creation of reports to schools became computerized in the state of Iowa in 1958. In addition, the Elementary and Secondary Education Act was accredited for the prominence of evaluating programs with the use of norm-referenced tests in 1965. There are numerous tests that exist currently and are administered to students before tests (Practice Scholastic Aptitude Test) are also taken by students in their junior year of high school, to prepare for the complete Scholastic Aptitude Test (Alcocer, 2017).

Huddleston and Rockwell (2015), as well as Lieberth (2016) and Kaukab and Mehrunnisa (2016), posited that successful candidates of the Scholastic Aptitude Test are given an opportunity to receive National Merit Scholarships. Similarly, President George Bush, in 2001, signed the No Child Left Behind Act, which paved the way for more accountability in schools. The No Child Left Behind Act implemented new measures to hold schools accountable for students' progress. The No Child Left Behind Act expanded

the role of standardized testing in American public education. This expansion led to students in Grades 3 through 8 to be tested every year in reading and math. Students have to take the End of Grade assessment on a yearly basis. The results from these tests are used to measure both teachers and schools (Alcocer, 2017). Since teachers and schools are being ranked based on the performance of these students, they have to implement instructional practices and utilize pedagogical tools that will help them to achieve the objectives set forth by the No Child Left Behind Act. Gamification is one pedagogical tool that educators have been using to help bridge achievement gaps and prepare students for standardize examinations.

History of Games in Education

Aberšek (2016) and Wilkinson (2016) cited that the history of games in education can be traced to the work of Plato in his book titled *Republic of Laws*. In *The Republic*, Plato stated that no compulsory learning can remain in the soul, teaching children, train them by a kind of game, and you will be able to see more clearly the natural bent of each. D'Angour (2013) and Baka, Daud, Nordin, and Abdullah (2015) agreed with Plato that play is a necessity in a child's development and children's play has educational value. D'Angour (2013) and Baka, Daud, Nordin, and Abdullah (2015) reiterated that Plato advocated that children learn naturally through play. Plato also believed that behaviors exhibited during play can be reinforced into adult behaviors. The use of games in education was also endorsed by Aristotle in his work *Politics and Ethica Nicomachea*. D'Angour (2013) believed that Aristole supported Plato's view that play was necessary for children's development and learning. In addition, Piaget and Vygotsky have made significant contributions in laying the foundation for the importance of games in

education. Piaget and Vygotsky believed that play is a necessity in a child's cognitive development (Barthold, 2014; Montealegre, 2016).

Russell and Ryall (2015) and Wilkinson (2016), posited that regardless of Plato's proposal that play has educational value, it was not until the end of the 18th century that play was observed as a necessity in a child's development. Wood and Attfield (2013) suggested that children from different social classes had minimal recognition in society as they were viewed as the immature form of adulthood. Wood and Attfield (2013) asserted that it was the work of Rousseau, Froebel, and Dewey, who are renowned classical theorists, that changed the views and attitudes of society toward children. Russell and Ryall (2013), also Wilkinson (2016) and agreed that it was Friedrich Schiller and Jean-Jacques Rousseau who laid the foundation for play to become a right of childhood. Thus, play was considered as an intrinsically purposeful activity.

Wilkinson (2016) believed that games are mediums through which children express themselves in their own world. Wilkinson (2016) asserted that their expressions are shaped by the rule-based boundaries of their games. Wilkinson (2016) further suggested that the difference between games and play is associated with the establishment of rules that are logical limitations, portrayed in different forms that formulate playful events. The different forms of educational games that existed in the 1960s and 1970s were mainly paper and pencil. Notwithstanding, throughout history, games were used for the purpose of entertainment until the early of the 20th century. There were several names used to refer to educational games such as business game, gaming and simulation, simulation, edutainment, political games, serious games, and more recently gamification.

Wilkinson (2016), as well as Noemí and Máximo (2014) and Laamarti, Eid, and Saddik (2014), posited that Clark Abt provided a specific term for educational games. These educational games have explicit and well-designed educational purposes. Abt (1970) can be credited for the popularization of the term serious game. In Abt's view, serious games provide prospects that can bridge the gap between motivational inadequacies in American educational system. The 1970s era laid the foundation for the expansion and improvement in serious games being an exemplified field.

Wilkinson (2016) concurred that there was a marked difference between corresponding play and game-based practices and other technological-centered pedagogical practices. Wilkinson also noted that there was a spiked increase in the video game industry 20 to 30 years ago, and human-computer interaction discipline happening simultaneously alongside an increase of modernized research in the discipline of serious games. Wilkinson postulated that the application of serious games in education increased significantly during the 1980s to 2002. Conversely, researchers such as Bogost (2015) and Arnold (2014) expressed disappointment with these games, noting the simplicity of these features. Wilkinson (2016) theorized that these games were encouraging drill, practice, and rote learning rather than promoting higher-order thinking skills. In addition, these games promoted motivation through the behaviorist idea of reinforcement. Loh and Sheng (2015) agreed that the use of computers and educational technology in classrooms emerged in the 1990s and was accredited, earning the term edutainment. This blended approach symbolized the merger of education and entertainment. Loh and Sheng (2015) reiterated that the objective was to make learning more enjoyable and appealing. On the

contrary, the quality of edutainment lessened, primarily attributed to poorly designed games by these publishers.

Loh and Sheng (2015) and Wilkinson (2016) agreed that in the mid-1980s to the late 1990s, there was a decrease in the volume of studies being conducted on nondigital games, with more emphasis being placed on digital games. Loh and Sheng (2015) further noted that Malone and Turkle were renowned researchers for commercial digital games to be applied in the educational context during the early 1980s. According to Loh and Sheng (2015), the popularization of the concept of digital game-based learning can be accredited to the work of Prensky in 2001 and Gee in 2003. Gamification was devised in 2003 by a British-born computer programmer and inventor named Nick Pelling; however, the term was not fully recognized until 2010 (Melwin et al., 2017). Oxford Analytica (2016) stated that first documented use of gamification was in 2008, but the term became popular during mid-2010 by several industry players and conferences.

Dicheva et al. (2015) and Todd (2016) believed that gamification is not a new phenomenon in education. Dicheva et al. (2015) and Todd (2016) stated that for many years, educators have been using game-like elements. A typical example put forward by Dicheva et al. (2015) and Todd (2016) was awarding points for the completion of assignments, which were converted to badges, which is known as grades. The house system and the use of gold stars were examples of forms of gamification used in the American education system.

What Is Gamification?

Melwin et al. (2017), as well as Marczewski (2013), suggested that gamification materialized in early 2000, as a concept of utilizing components of game design in a

nongamified setting. Seaborn and Fels (2015) posited that there are many definitions for the term gamification. Seaborn and Fels (2015) noted that, to date, there is no comprehensively recognized logical definition for the term. According to Marczewski (2013), the definition of gamification was not specific to the components of gamification. Numerous researchers have expanded its definition and provided more specific details on the components and their purposes. Attali and Arieli-Attali (2015), likewise Enders (2013) and Glover (2013), asserted that elements of gamification include points, leaderboards, and badges. These elements are used in nongame contexts to encourage active engagement of its users (Attali & Arieli-Attali, 2015; Enders, 2013; Glover 2013). Werbach (2014) posited that gamification involves the utilization of game thinking as well as the components of games in engaging participants in problem-solving activities. Werbach's definition also provided specific details on gamification components that were insightful and parallel to important aspects of comprehensive gamification literature.

In a similar vein, Kapp (2013), Kim (2015), and Zichermann and Linder (2013) maintained that gamification involves the utilization of components and techniques of games in the context of nongame activities. Kapp (2013), Kim (2015), and Zichermann and Linder (2013) emphasized that gamification can be used to promote engagement, motivation, learning, and problem solving. Stating the contrary, Werbach (2014) noted that not all activities that involve game design elements in nongame contexts necessitate being characterized as gamification. Werbach further pointed out that the use of any one component of game design element would suggest using the term gamification. Werbach made reference to the progress bars in computer programs, which are specifically designed to provide feedback to the user. This component should not be referred to as

gamification, as it was designed as feedback device as opposed to having game purposes. While researchers such as Kapp (2013), Kim (2015), and Zichermann and Linder (2013) defined gamification, they have failed to make specific and adequate connections between gamification and mathematics.

Conforming to Engagement Alliance (2015), gamification creates the ideal context for behavior change and successful outcomes through the influences of using game strategies, reliable program design, and social finances. Kim (2015) avowed that educators can use gamification to intensify students' engagement and instruction. Bartel and Hagel (2016), as well as Deterding, Björk, Nacke, Dixon, and Lawley (2013) and Dicheva and Dichev (2016), concurred that the main aim of gamification is to increase students' motivation and engagement toward education in a similar manner as they do in other games. Importantly, learners' motivation and engagement will improve. However, gamification has to be implemented correctly to have such an effect. In a similar vein, it is important to consider when game formats are adequate. This is necessary to eliminate boredom and other challenges that may emerge when learners have mastered concepts.

Nicholson (2013) cautioned that the long-term goal of gamification should be to lead students into deeper engagement. Nicholson noted that gamification should be designed in layers that can be removed gradually. Furthermore, the end results of gamification should be seen as a journey to bring about lifelong change as opposed to being viewed as a cycle. Mekler, Brühlmann, Tuch, and Opwis (2015) maintained that rewarding students with points, badges, and leaderboards should not be the significance of gamification, as this benefit could later be viewed as being superficial. In this case, this method has disparaged gamification to be contemptuously characterized as pontification.

According to Werbach and Hunter (2015), there are three important guidelines to follow in order for gamification to be properly implemented. First, one must have an understanding of the players who are the targeted audience. Second, clear objectives should be established for the activity or system so players can know what they are intended to do. Third, it is recommended that suitable components of the game be used to encourage the participants to perform. From an educational perspective, it is essential to understand the students and their viewpoints as they are the players in the system. This is of utmost importance in order to improve students' motivation and engagement, thus encouraging the success of a gamified classroom.

Villagrasa, Fonseca, Redondo, and Duran (2014) asserted that in gamifying a lesson, course, or idea, there are rules that must be followed. For example, while students are having fun and performing learning activities, they can receive rewards through leaderboards and badges. The aim of gamification is not to play games, but rather to ensure that students gain the necessary level of motivation to complete the assigned tasks effectively. Villagrassa et al. shared the view that in order for students to overcome a challenge, they must develop a feeling of accomplishment and success. Dominguez et al. (2013) suggested that it is important to consider the major components of video games that interest its players when constructing a gamification system that increases student motivation. Game mechanics and game dynamics in nongame situations use characteristics of video games, which are applicable to gamification (Buckley & Doyle, 2014).

According to Enders (2013) and Grünberg (2014), game mechanics are devices, techniques, and tools that are used as the basis of gamifying a Web site or application.

Some of the different types of game mechanics that can be used to increase students' engagement include achievements, community collaboration, infinite game play, and levels. Rewards earned after completing a challenge are referred to as bonuses. When a community works together as a team to solve a problem, it is known as community collaboration, while infinite game play refers to when the player engages in a continuous game. Levels involve players advancing to the next stage of the game after mastering a new challenge and achievements (Ollikainen, 2013; Robson, Plangger, Kietzmann, McCarthy, & Pitt, 2015).

The Brain and Gamification

Ängeslevä (2014) asserted that gamification allows an individual to utilize multiple senses. The author believed that gamification also coerces an individual to be engaged in the continuous processing of information as opposed to reciting it in the future from transcripts or from their long-term memory. The author stated that the use of games stimulates the brain and helps to increase its flexibility. In essence, it modifies the structure of the brain through stimulus and learning capacity. This change occurs faster and smoother in children than adults, as they are better able to demonstrate it in their learning. Children are better able to adapt to changes and new ideas than their adult counterparts (Ängeslevä, 2014).

Sailer, Hense, Mayr, and Mandi (2017) affirmed that gamification has the ability to produce psychological effects. Chanda and Levitin (2013) confirmed the release of dopamine, epinephrine, and norepinephrine in the brain when game playing, which helps individuals feel good. Chanda and Levitin theorized that dopamine is a necessary reward as well as a chemical that enhances learning. Similarly, Miller's (2015) studies

demonstrated that learning necessitates neural connections within the brain in order for information to be stored in memory. Miller believed that learning in most cases is as a result of reactions from an actual event.

Miller (2015) further cited that actual and stimulated events are not distinguished by the brain. In order to form neural connections, learning must be validated through stimulating conditions that demonstrate a skill. This neural connection is developed in the brain. However, before the actual event can be experienced, the proper response must be stored. Experience of the actual event is then followed by a learned response. The skill set of an individual as well as his or her knowledge and attitude are key ingredients of learning a game. Kapp, Blair, and Mesch (2013) believed the powers of reasoning, spatial thinking, and evidence-based decision making have a direct relationship between gaming and problem-solving skills.

Benefits of Gamification

Deterding (2014) and Dicheva et al. (2015) posited that effective gamification motivates and engages players for an extended period. The ideas, conceptions, preconceptions, and experiences of students in a mathematics classroom are productive when they are actively engaged. Deterding (2014) added that gamification application in nongame context has the potential to re-create a similar motivational level and engagement for other purposes. According to Freeman et al. (2014), Laursen et al. (2014), and Bressoud and Rasmussen (2015) asserted that active engagement techniques allow students to learn mathematical concepts more effectively and improve their academic performance.

Katmada et al. (2014) concurred that mathematical games appeal to students' interest and help in establishing better learning environments. Based on their research Katmada et al. theorized that students' performance can be significantly impacted and can depict the engagement that goes on in the teaching-learning. Students at the elementary level delight in playing mathematical games, thus, taking advantage of their personal interest in the subject can impact their academic performance.

Werbach (2014) offered that the objective of gamification is not merely setting objectives and providing rewards on top of content. It should be reflective of a thoughtful approach in order to integrate the characteristics of games into learning through an intentional approach. It is important for learners to understand why a game is important. This will help them to discern the skills to be generalized beyond the game format and into authentic problem solving. Nicholson (2013) agreed that gamification should be designed so that learners are able to make the transition into the authentic real-world setting. Werbach (2014) further lamented that game thinking necessitates careful consideration and understanding of motivation and design practices as opposed to being just a badge and leaderboard system. Werbach believed that psychology and technology can be influenced by the use of effective gamification.

Katmada et al. (2014) and Zakaria, Solfitri, Daud, and Abidin (2013) identified mathematics as one of the least favored subjects by students at all levels of schools in America. The views of Appiah (2015) were that it might be possible to bridge this gap. Appiah asserted that gamification can be a valuable means of promoting behavioral changes and encouraging preferred attitudes in students. This, Appiah believed, is quite synonymous to persuasive technology. Hamari, Koivisto, and Sarsa (2014) concurred that

persuasive technologies are technologies that are intended to impact the operator's behavior without coercing the change. In order to impact a behavior, there should be a clear understanding of how the behavior is created as well as what influences it.

Nicholson (2013) suggested that motivation is an important element to reflect on in gamification. Nicholson cited that rather than emphasizing the use of external rewards and establishing a scoring system, effective gamification emphasizes having fun while promoting active engagement. Nicholson's (2013) views are quite synonymous with the aim of this research, in which students are expected to learn mathematical concepts as opposed to just receiving a scoring system and external rewards. Afari, Aldridge, Fraser, and Khine (2013), likewise Trinter, Brighton, and Moon (2015), agreed that students' mathematical or arithmetic skills, as well as mathematical instructions, conceptual understanding, and problem-solving skills can be improved through the use of games. Afari et al. (2013) and Trinter et al. (2015) agreed that the appropriate use of games as a pedagogical tool can contribute to students' academic success.

Nicholson (2013) believed that gamification can drive human behavior. The implementation of gamification on students' learning and motivation has been found by many researchers to yield positive results. The use of gamification is not a new idea but is somewhat different from how it is used in other organizations and institutions. Nicholson (2013) compared gamification with serious games and inferred that the objective of serious games is to accomplish nongame results. On the other hand, the objective of gamification is to attain better learning outcomes. Ke (2014) believed that many children enjoy solving problems mathematically, specifically in unpredictable circumstances.

Learning outcomes can be improved through the use of game elements that will aid in them becoming more enthused and committed to the learning process (Ke, 2014).

Perrotta, Featherstone, Aston, and Houghton (2013) posited that there is much evidence that games can be an effective pedagogical resource for gaining, providing knowledge and engagement both formally and informally. It extends to developing subject-knowledge skills, attitudes, and behaviors. Katmada et al. (2014) conducted a study on the use of digital games in learning of mathematical concepts. Katmada et al. did an experimental study with 12 students and a longitudinal study with 37 students throughout a 14-week period. Findings from the study revealed that students' perception of the game were positive. Katmada et al. (2014) reported that games were effective learning tools for improving students' understanding of mathematical concepts as well as being an effective pedagogical method of instruction. Kapp et al. (2013) professed that there is a substantial amount of research to prove that game-based learning is more stimulating for students. Kapp et al. (2013) and Katmada et al. (2014) were of the view that gamification is an effective pedagogical tool in helping students improve their critical thinking and problem-solving skills.

Stott and Neustaedter (2013), de-Marcos, Dominguez, Saenz-de-Navarrete, and Pages (2014) determined that there are several educational benefits that can be achieved from using games in a classroom setting. Robson et al. (2015) stated that some forms of gamification tools or platforms allow the player to restart and play again as well as recover from mistakes made. Rutherford (2015) concurred that in a classroom setting, students should be provided with multiple opportunities to play games. During the process, teachers provide opportunities for mathematical ideas to develop. This will then

help students to recognize current examples, relationships, and strategies. Games are beneficial in allowing students to receive feedback in a class where time constraints do not allow individual attention. In essence, the teacher can evaluate and provide individual feedback through gamification, which would not be possible through standard instruction.

Kapp et al. (2013) offered that the use of gamification helps to bridge the gap between maximizing instructional time and providing individual attention to students. Kapp et al. believed that the maximization of instruction time became possible through the features of the game that incorporate immediate and frequent feedback. Kapp et al. added that teachers normally instruct students through scaffolding. Haider and Yasmin (2015) defined scaffolding as the process through which teachers provide assistance to learners. This is done with aim of enhancing learning and assisting learners in fully understanding concepts. Scaffolding sometimes does not cater to students' individual needs as opposed to the use of gamification, which is more beneficial (Kapp et al., 2013). Lawton et al. (2013) theorized that games monitor the individual player's progress and permit further advancements only when mastery is attained.

Leaderboards encourage engagement by providing a competitive environment. Kapp et al. (2013) posited that one attribute of leaderboards are their competitive nature, which is beneficial in stimulating engagement while pictorial display of players' progress can be achieved through the use of badges. Furthermore, although there are various assumptions about the benefits of gamification, inadequate empirical study exists on the effectiveness of gamification on mathematics instruction (Brunsell & Horejsi, 2013). Bellotti et al. (2013) attested to using leaderboards in an entrepreneurship course and experienced higher student interest and engagement.

Appiah (2015) conducted a qualitative research study measuring the effects of a gamification model on the interest and performance of students in the area of mathematics. This study focused on 125 students and three teachers, all at the lower elementary school level. The findings indicated that the intervention positively impacted the dynamics of the classroom as well as leading to new teaching and strategies. In addition, students became more engaged and active in learning mathematics, thus, enhancing pupil-teacher interactivity. Appiah (2015) cited that there is a possibility for gamification to become a compulsory pedagogical tool in teaching mathematics at the elementary level. This can be attributed to its ability to increase students' engagement, interaction, and motivation, thus creating a more enjoyable environment for learning mathematics.

Browne, Anand, and Gosse (2014), likewise Hamari et al. (2014) and Walsh (2014), agreed that amid shaping behavior, gamification helps to develop critical thinking skills, foster collaboration, and increase user engagement. Tobias, Fletcher, and Wind (2014) believed that the use of gamification in education helps to make the learning experience more meaningful and interactive. Rutherford (2015) postulated that it is necessary to provide to students' multiple opportunities in a mathematics classroom. Rutherford asserted that this would aid students in becoming more fluent with number knowledge and improve their skills in working with multidigit numbers. The use of gamification in fostering meaningful practice can help students become more motivated and begin exhibiting behaviors that are transferable to real-life situations. In this global era, it is imperative for students to be able transfer their learning of mathematical concepts to real-life situations.

When students are able to make connections with real-life situations, they will be more appreciative of the value, extent, and boundaries of mathematics in governing their everyday decisions. These behaviors will be later transferred to their livelihood and add to lifelong learning. Hanus and Fox (2015) postulated that gamification has the capability to inspire students to learn in new ways, which were otherwise monotonous. Gamification can either decrease or increase learners' motivation based on how it is used. However, the primary purpose is to increase intrinsic motivation (Buckley & Doyle, 2014).

Kapp et al. (2013) compared the traditional approach to instruction with instructional approaches that use gamification and suggest that traditional instruction focuses more on the objectives rather than focusing on the learning outcomes. A traditional approach to instruction also includes bulleted lists rather than interactivity, summative assessments, and not constant helpful feedback. Dicheva et al. (2015) suggested that a traditional approach to instruction is ineffective, while gamification offers a more personalized and student-centered learning. The effects of interactivity, constant corrective responses, and the challenges are key characteristics for achieving gamification's objective, as well as positively impacting learning outcomes.

Gamification also increases students' motivational level to study because of the continual corrective response feature (Richards, Thompson, & Graham, 2014). Richards et al. (2014) believed that this characteristic pushes students forward, thus increasing their interest as well as allowing them to be more enthused about the learning process. Continual corrective feedback in mathematics can have a positive effect on students' attitude and improve the quality of their solutions in problem solving. Dicheva et al.

(2015) agreed that the use of instant feedback will allow students to feel more comfortable to take risk in trying new and challenging things. This can be attributed to their ability to regulate their actions accordingly. Dicheva et al. (2015) maintained that students are able to visualize that every effort is valued, and they are achieving some level of success. This helps them to develop a feeling of accomplishment.

Similarly, Miller (2015) posited that gamification connects better with students' expectations and 21st century skills. This may be attributed to the goal of having better engagement and motivation. Gamification epitomizes subject-based knowledge, teamwork, systems thinking, collaboration, media literacy, epistemological theories, and critical-thinking skills. These are important skills that help to equip students to meet the demands in the current era. Miller cited that gamification, as well as elements of games, exemplify the skill sets that support the 21st century generation of students; thus, having a greater impact on the production of the educational system. The ideas put forward by Miller (2015) that gamification connects better with 21st century skills mirrors Qing, Lemieux, Vandermeiden, and Nathoo (2013) when they wrote that mathematics skills are important skills for students to develop in order to succeed in today's world.

Garland (2015) noted that gamification affords educators the opportunity to add to current skill sets as opposed to reeducating as a game designer. It also allows educators to reconsider prior materials instead of starting over completely. It provides an avenue for educators to exhibit lower expectations. Many of the components of gamification are psychologically based and, as a result, it can be used to enhance learning. These procedures and methods have been utilized previously by curriculum planners, educators, and professors. The use of helpful feedback, providing students with points as a form of

reward, and encouraging teamwork on assigned tasks have all been explored by experts in the field of education.

Kapp et al. (2013) suggested that the key distinction of gamification is that it adds a provoking dimension by combining those elements to form a more interesting and engaging atmosphere. Students will become more motivated in the learning process. Werbach (2014) concurred that gamification allows educators to be better equipped in engaging, guiding, and rewarding students toward specific goals. Ideally, educators have the skill set, knowledge, and abilities to implement effectively gamification in the teaching and learning process (Kapp et al., 2013).

It is often extensive, complex, and expensive to design fully a complete gaming system. On the contrary, the introduction of gamification in the learning environment allows educators to use games that are inexpensive. These games can be applied gradually, making the task simpler and adaptable. Minor changes can be made to specific sections of courses, which can be improved and added eventually. Educators also have the opportunity to gamify an entire program in a sequential order, permitting for future developments. Kapp et al. (2013) cautioned that it is important to gamify the learning process without altering the content of the program. Second, it is imperative to alter the course content in order for it to depict an Alternate Reality Game.

Additionally, there are other benefits that can be derived from the use of gamification. These are not limited to student engagement and motivation (Barata, Gama, Jorge, & Gonçalves, 2013; Goehle, 2013). Goehle (2013) added that it also extends to students' feelings of being recognized and successful. According to Vella (1994), learning to be successful in a safe learning environment must be established. Thus, the

mathematics learning environment should epitomize this approach. Remmele and Whitton (2014) agreed that for games to have a positive effect on students' motivation, a safe and supportive environment is paramount. Barata et al. (2013) attested to students being more dedicated and receptive in a gamified course. In a similar vein, Goehle (2013) stated that gamification aids in students not only working for a grade but also completing a task effectively.

Kapp (2016) suggested that gamification also allows educators to provide more personalized learning opportunities to students. Zając and Piekarczyk (2014) stated that gamification exemplifies personalized learning, as students are being afforded with an opportunity to select their learning experiences. Gamification allows students to have more authority over their own learning; thus, pursuing more appealing activities that will help them to discover better achievements (Zając & Piekarczyk, 2014).

Criticism of Gamification

There are many criticisms surrounding the idea of whether gamification is a new concept. Researchers such as Gangadharbatla and Davis (2016) as well as Sailer et al. (2017) have pointed out that gamification is a new trend. On the contrary, Todd (2016) asserted that gamification, as well as its application, is not a new concept. Todd is of the view that gamification already existed in grade levels, scholastic grades, and marketing prior to its recurrent implementation (Armier, Shepherd, & Skrabut, 2016; Seaborn & Fels, 2015). The resurfacing of gamification can be attributed to the increase of less expensive technology, personal data tracking, and the pervasiveness of game platforms (Seaborn & Fels, 2015). A. C. Y. Hung (2017) posited that many criticisms of

gamification stem from the term itself. A. C. Y. Hung (2017) theorized that the definition of gamification is not specific.

According to Seaborn and Fels (2015), gamification has different meanings, inconsistent procedures, dissection on its scholarly worth, immature hypothetical establishments, and a need of institutionalized application. Biro (2014) agreed that gamification is often defined by the setting in which it is used. A.C. Y. Hung (2017) suggested that the term gamification continues to be deceptive and ambiguous. Biro (2014) and A. C. Y Hung (2017) suggested that the realities of gamification are superficial in their applications.

Cook (2013) argued that gamification requires well thought out design and execution in order to reflect the true characteristics of games. Arnold (2014) agreed that merely adding badges and points systems to an experience does not exemplify a game or active engagement. Badges, levels, game currency, and points are components of gamification that sometimes allow for overapplication of extrinsic motivators (Hamari, 2013). These can have a negative impact on intrinsic motivators, allowing internal motivation to decrease in players in their quest to pursue targeted behaviors and activities. Mollick and Rothbard (2014) suggested that gamification creates an opportunity for rules to be imposed on its players that decreases the positive affect. Conway (2014) highlighted that this is known as zombification, which in essence is an irrational quest for external rewards. This absence of independence or aptitude sometimes allows students to visualize gamification curricula as the source of additional stress. Students will become fearful of the additional pain of not being able to level-up fast

enough or not being able to achieve the highest ranking as opposed to experiencing unexpected disappointments (Juul, 2013; Stott & Neustaedter, 2013).

Hamari (2013) pointed out that students sometimes concentrate on achieving more points and new levels as opposed to adaptation of learning. Gamification encourages habituated and infatuated behavior among individuals with related persona. There is a possibility for learners to be dependent on the reward or point based on previous activity in order to complete current activities. The learner may develop preconceived ideas of having new activities as a disadvantage, owing to having received rewards from previous activities.

Morozov (2013) referred to gamification as a form of technological solutionism. Morozov believed that today's generation oftentimes refuses to define and understand the nature of a problem before seeking technological solutions. Haaranen, Ihantola, Hakulinen, and Korhonen (2014) suggested that the use of gamification will not benefit or motivate all students. Some students may become distracted by the entertainment feature of the game. There is a possibility for students' attention to be diverted from the content; therefore, they will not be involved in developing critical-thinking skills.

Haaranen et al. (2014) cautioned that when presenting gamification, the competitiveness should not induce carelessness among students. In addition, Dominguez et al. (2013), as well as Glover (2013), warned that the aforementioned should not demotivate students. The high levels of public competitiveness could negatively impact learning and motivation. This can be attributed to students having more points than their competitors; rather than implementing external competitions, internal competitions

should be implemented. Furthermore, students may feel more comfortable competing against themselves and making progress rather than total accomplishment.

According to Haaranen et al. (2014), some students dislike the use of badges; however, they suggested that these should be built-in features of gamification systems. Therefore, students will have the option to utilize these features. Markopoulos, Fragkou, Kasidiaris, and Davim (2015) posited that the use of gamification in learning can increase extrinsic motivation in students, thus diminishing the role of intrinsic motivation. Markopoulos et al. (2015) are of the view that some educators do not consider gamification as an important pedagogical tool. Many educators are fearful that gamification will consume much of their class time, resulting in them not fully covering their curriculum content.

Gamification Design

According to Christy and Fox (2014), leaderboards and points are gamification elements that must be evident in a gamified classroom. They believed that this information should be displayed for students to be able to make comparisons with their peers. Jung Tae and Won-Hyung (2013) suggested that it is imperative to adopt the Attention, Relevance, Confidence, and Satisfaction framework when designing a dynamic system. This can be attributed to teaching and learning not merely being points and leaderboards but designing a curriculum that encompasses gamification that can be time consuming. Hence, it must be done properly, or its educational value will be lost (Hanus & Fox, 2015).

DeByl (2013) assumed the position that a gamified course structure can be developed through the proper utilization of different gaming features. These features can

be combined with detailed information about a particular curriculum that will provide enjoyment and engagement for the students. Kim (2015) pointed out that the outcome of the game should be clearly defined. Kim believed that an understanding of the features of the course or particular situation is mandatory for the teacher's motivation and the Flow Theory. Flow theory is sometimes referred to as the optimal experience and was developed by Mihaly Csikszentmihalyi. Csikszentmihalyi (1993) defined flow as a psychological state of awareness where an individual experienced genuine satisfaction when he or she is fully immersed in an activity. Csikszentmihalyi suggested that flow is often experienced when activities are challenging and involve creative abilities.

Gamification and Motivation

Christy and Fox (2014) averred that the use of game mechanics in a classroom setting implies that the use of incentives can motivate students extrinsically and inspire them to advance to the next level. Dörnyei (2014) further explained that gamification involves more than rewards and punishment. He added that it is the quality of the motivational strategies that are used that makes the difference and not the quantity. Furthermore, Dörnyei (2014) mentioned that competition, cooperation, and learning activities that are interesting, as opposed to being tedious, are motivational strategies that can aid in making gamification beneficial to students. Jovanovic and Matejevic (2014) confirmed that there is a strong relationship between reward learning and motivation. This characterizes what gamification has to offer; hence, students become more motivated through the components of gaming not only by earning the next incentive but by moving to the next academic level in the game.

Rutherford (2015) postulated that educators can inspire students to discover number knowledge and other important mathematical concepts through the use of mathematical games. The author suggested that these games have the potential to improve students' mathematical understanding and reasoning. DeByl (2013) agreed students could level up as they progress through a specific curriculum. Jones (2015) agreed that games can be used to motivate and improve students' achievement in mathematics. However, Jones (2015) believed that in order for students to improve their academic achievement, they first have to be motivated. Espinar-Redondo and Ortega-Martín (2015) agreed with Jones (2015) that motivation is widely accepted as being important to learning and, as a result, it can have an affirmative or undesirable effect on students' overall performance. Extrinsic and intrinsic motivation are two specific kinds of motivation.

Lepper and Greene (2015) posited that intrinsic motivation involves behavior that is driven by internal rewards and for the enjoyment it provides. In addition, it also involves the knowledge it authorizes, or the feelings of accomplishment it evokes. On the other hand, extrinsically motivated behavior involves behavior that is driven by external rewards. Lepper and Greene (2015) asserted that intrinsically motivated students perform better as opposed to those who are extrinsically motivated.

Rissanen (2014) maintained that when teachers used games in mathematics instruction, they are using students' personal interest to heighten their motivation. Intrinsic motivation is more influential in the classroom and the objective of gamification is to motivate extrinsically students, which can, over time, allow students to become intrinsically motivated. Landers and Landers (2014) concurred that proper

implementation of gamification can impact students' attitudes and behavior, which can later extend to them becoming intrinsically motivated. Students who are intrinsically motivated will complete a task independently or pursue to develop skills without being instructed to do so. Afari et al. (2013) stated that when games are presented in a mathematics classroom, students' motivation will increase immediately.

Implementation of Gamification in the Classroom

There are many different ways in which gamification can be implemented in the classroom. Kiryakova, Angelova, and Yordanova (2014) explained that it is important to determine the characteristics of each learner when implementing a gamified system. This, Kiryakova et al. (2014) believed, is necessary in determining if the system would be appropriate. The fundamental and definitive variables are the students' inclination to relate to the content and ability to engage in a competitive learning environment. Educators should institute and be cognizant of the required skills for students to achieve the desired objectives. Huang and Soman (2013) agreed that the learners' motivation to be involved in the process will be dependent upon the background of the learning process and happens after they have achieved their accomplishments.

Kiryakova et al. (2014) asserted that the second step should involve defining the learning objective. In a gamified setting, the learning objectives should be explicit and well-defined. The main aim of education is to attain learning objectives; otherwise all undertakings as well as gamification activities would be futile. The objectives are important in deciding the instructional materials and activities that are appropriate in the learning process. It also helps to determine the appropriate gaming system and methods that can be used to achieve these objectives. The third step suggested by Kiryakova et al.

(2014) is creating the educational content and activities for the gamified system. It should be engaging, interactive, and encompass interactive programs. Simões, Redondo, and Vilas (2013) stated that the activities should be aligned with the learning objectives.

Simões et al. (2013) postulated that the process should allow learners to have multiple opportunities to perform a task in the event their attempt is unsuccessful. Apostol, Zaharescu, and Alexe (2013) concurred that failure is an essential element in games. Apostol et al. (2013) theorized that this approach to failure creates new prospects for teachers and students to engage in meaningful discussions. Simões et al. (2013) agreed that allowing students to be engaged in repetitious practice exercises will allow them to develop their skills. Simões et al. (2013) maintained that the learning activities should be practical and achievable in order to meet the needs of the students. Simões et al. (2013) noted that various pathways should be created for students to achieve the desired objectives. This will foster active learning that will allow the learners to develop diverse skills and shape their own approaches.

According to Simões et al. (2013), the final step should be to add the game features and tools. This stage will reflect the main aim of gamification and the inclusion of activities the students have to accomplish. When these activities are accomplished, then students will amass points, level up, or earn awards. The objective of these actions is to garner the desired learning objectives. The tools to be added to a gamified system are dependent upon the objective to be achieved. They take into account understanding and the expertise, which are required to complete the task. For example, tasks that are completed individually necessitate individual rewards.

Werbach (2014) theorized that there are six steps for gamification to be established successfully. Werbach suggested that the first step should be to define clearly the objective of gamification. This can be attributed to the fact that the main aim of gamifying the system is to achieve this objective. The second step proposed by Werbach (2014) was delineating the target behaviors. The desired behavior is described at this stage and the players become aware of the expectations. The third step involved describing the players. It is important be aware of the types of players that will be involved in a gamified system because every player is unique and not every player plays the game for the same reason.

The fourth step involves devising an activity loop (Werbach, 2014), providing comprehensive explanation of the kind of feedback system that will be utilized. Peelen and Berg (2014) defined an activity loop as the repetitive structures and actions that motivate players to move forward in the gamified system. Peelen and Berg (2014) asserted that activity loops stimulate actions, which further ignite an action. The next step entails explaining the fun feature that enables the system to inspire and engage its users. Last is deploying the appropriate tools for the system to function effectively (Werbach, 2014).

DeByl (2013) customized her course using different aspects and elements of gamification such as levels, leaderboards, badges, and social engagement loops. DeByl investigated and evaluated a gamified course curriculum structure in two subject areas at the university level. The objective of the research was to measure the effectiveness of a gamified curriculum on the students' engagement. DeByl's purpose was to demonstrate an understanding of the characteristics that epitomized it as an effective pedagogical tool

in education. The findings indicated that students were enthused and motivated to complete a task and earned points outside of the classroom. DeByl (2013) confirmed points, levels, leaderboards, and badges, social engagement loops, were effective in evoking students' interest. Though students were enthused and motivated, this study failed to clarify the specific element of gamification that had such an effect on students.

Hanus and Fox (2015) conducted a longitudinal study investigating the effectiveness of gamification in the classroom throughout a 16-week period. Hanus and Fox reported that at the end of the course, students' motivational level decreased after using leaderboards and badges. Four surveys were administered to 71 students in gamified and nongamified settings. The study focused on students' academic performance, effort, learner empowerment, motivation, satisfaction, and social comparison. The findings indicated that in the gamified setting, students were less motivated, empowered, and satisfied, which resulted in having a negative impact on their overall performance. This comparison between a gamified and nongamified classroom were clear in validating the findings. However, only two elements of gamification were used; there are other gamification elements that could have provided a different result. Therefore, a generalization about gamification cannot be made unless all the elements have been taken into account.

On the contrary, Kingsley and Grabner-Hagen (2015) used gamification elements such as adding badges, power ups, awards, and levels in a course. The authors also used effective instruction along with those elements to motivate students as they learned skills that are important in the current era (Kingsley & Grabner-Hagen, 2015). It was clear from

their study that gamification can have a positive or negative effect on students' motivation and by extension their academic performance.

Ozcelik, Cagiltay, and Ozcelik (2013) suggested that for individuals to advance to another level of play, they are required to draw on prior knowledge. They are also expected to connect it to new information and situations, apply the information in the correct context, and learn from instant feedback. Having an optimal flow experience and the motivation received from playing games are contributing factors for individuals to develop the desire to learn. Individuals generally spend an extended period of time engaging in the subject of the game. They are enthused within such an atmosphere and, as a result, their level of motivation is often high (Ozcelik et al., 2013).

Researchers such as Hamari (2013) as well as L. X. Chen and Sun (2016) and Whittaker-Powley (2015) have capitalized on the opportunity to expound on the flow theory. Csikszentmihalyi (1993) asserted that flow involves a certain level of awareness that is experienced when an individual is engaged in an entertaining activity. This theory is applicable to the aim of gamification. Ozcelik et al. (2013) posited that during the optimal flow, individuals are so engrossed in the activity that their psychological state allows them to lose track of time and forget about their environment. Research has proved that individuals' optimal flow can be heightened, in addition to their critical-thinking skills. This may become possible through engaging in computer games (Ozcelik et al., 2013).

Gamification is more than being involved in a competition. The aim is to develop the relevant skills to progress to the next level. Individuals often develop a feeling of completeness and satisfaction once they have overcome each level. Pappas (2013)

averred that self-paced learning and self-gratification can be achieved by allowing students to interact with materials, students' interaction, and engaging them in solving new problems. When students are able to learn and interact with their materials, a collaborative and constructive learning experience is created. This experience allows them to develop feelings and action as well as thinking critically. Game-based systems are interactive platforms that are customizable and individually paced. Game-based learning can have a significant impact in making the connections with classroom theories and real-life situations.

Summary

This research was grounded in the theoretical framework of Piaget and Vygotsky's theory of constructivism as well as Skinner's theory of operant conditioning and Bandura's self-regulation theory. There is inadequate knowledge on how teachers perceive the effects of gamification on students' academic performance on mathematics standardized examination. There are gaps in literature on the experience of elementary teachers using gamification in mathematics instruction. Much of the literature is either quantitative studies or focuses on higher education as opposed to elementary school teachers.

Gamification emerged in the early 2000s (Marczewski, 2013). Elements of gamification include avatars, badges, points, and leaderboards. There are many benefits associated with gamification; these include increased motivation and engagement (Bartel & Hagel, 2016; Deterding et al., 2013; Dicheva & Dichev, 2016). In addition, gamification produces psychological effects and allows an individual to utilize multiple senses (Ängeslevä, 2014; Sailer et al., 2017).

Nicholson (2013) cited that gamification drives human behavior. Browne et al. (2014), likewise Hamari et al. (2014) and Walsh (2014), agreed that in addition to shaping behavior, gamification helps to develop critical-thinking skills, foster collaboration, and increase user engagement. Gamification as a pedagogical tool is not without criticism. Researchers such as Gangadharbatla and Davis (2016) as well as Sailer et al. (2017) have pointed out that gamification is a new trend, but Todd (2016) asserted that the term as well as its application is not a new concept. It existed in grade levels, scholastic grades, and marketing (Armier et al., 2016; Seaborn & Fels, 2015). Seaborn and Fels (2015) stated gamification has different meanings, inconsistent procedures, dissection on its scholarly worth, immature hypothetical establishments, and a need of institutionalized application.

Hamari (2013) pointed out that students sometimes concentrate on achieving more points and new levels as opposed to alteration of learning. This literature review also highlighted the process involved in implementing gamification as well as its impact on motivation. In conclusion, learners' motivation and engagement can improve; however, gamification has to be implemented correctly to have such an effect.

Chapter Three of this research highlights the methodology and research design. It was executed using a qualitative method through the use of an exploratory case-study design. Therefore, the aim of this qualitative exploratory case-study research design was to gain an understanding of teachers' perspectives on the effects of gamification on the academic performance of students in mathematics at the fourth and fifth grade levels. Creswell (2013), likewise Yin (2014) as well as Stewart (2014), stated that the use of qualitative research becomes relevant when a problem needs to be investigated. Creswell

(2013), Yin (2014), and Stewart (2014), also stated that this method is relevant for investigating perceptions of individuals who are living the experience. In compliance with their recommendation, the methodological framework was aligned with the data collection and analytical techniques. It also included a research plan detailing the selection of sites and participants. Policies and guidelines for protecting the privacy of the sites and participants was also be outlined in this chapter.

Chapter Three

Methodology

This study began with an overview of the methods and design selected as well as identifying gaps in literature. Subsequent sections outline the methodology, research design, procedure, instrumentation, data collection, population, sampling, data analysis procedures, validity of the study, and reliability of the study. This chapter concludes with ethical considerations, a brief summary and lead to Chapter Four.

The study addressed two research questions:

1. How do teachers perceive the effects of gamification on fourth and fifth grade students' academic performance on mathematics standardized examinations?
2. How do teachers perceive the implementation of gamification on students' success?

In common parlance, a research study is a search for knowledge. Qualitative and quantitative are two approaches that could be applied in this study. Creswell (2013), Yin (2014), and Stewart (2014) cited that a qualitative approach is used to provide detailed descriptions of contextual material about the case setting, gathering extensive material from multiple sources to provide an in-depth picture of the case. On the contrary, a quantitative approach is used to quantify attitudes, behaviors, opinions, and other defined variables and generalize results from a larger sample population. A quantitative approach uses measurable data to formulate facts and uncover patterns in research. Creswell (2013), Yin (2014), and Stewart (2014) asserted that a qualitative approach exemplifies vigorous and conveyed reality while a quantitative approach exemplifies static and measured reality.

In determining the type of research method (qualitative or quantitative) is dependent on the research problem and the research questions to be addressed. Based on the nature of this work, the research on this subject was executed using a qualitative approach. According to Creswell (2013), the use of qualitative research becomes relevant when a problem needs to be investigated. Creswell (2013), Yin (2014), and Stewart (2014), all stated that the use of qualitative research becomes relevant when a problem needs to be investigated. The main objective of qualitative research is to answer why and how questions (Creswell, 2013; Stewart, 2014). Therefore, this study employed a qualitative approach to explore teachers' perception of gamification on students' academic performance on mathematics standardized exams at the fourth and fifth grade levels.

A qualitative approach was also applicable from the perspective of a wider academic writings. The qualitative method has wide applications in gamification and mathematics (Appiah, 2015; C.-M. Hung et al., 2014; Geelan et al., 2015; Katmada et al., 2014) but this does not imply room is unavailable for further study to be conducted. A qualitative study was appropriate because it seeks to answer descriptive and explanatory questions as opposed to a quantitative approach, which would require statistical data (Koskey, 2016).

A major attribute of this method was that it allowed the researcher to uncover trends in thought and opinions, and dive deeper into the problem (Yin, 2014) of gamification in mathematics instruction. A quantitative approach would not be ideal for this research, as its objective does not extend to studying things in a natural setting. Alternatively, a qualitative approach examines how the situation affects individuals. In

addition, in order for a quantitative approach to reflect statistical accuracy, a large population must be studied. A qualitative approach provides more detailed and rich data (Creswell, 2013; Yin, 2014). It seeks to answer questions about an individual's perspective, meaning, and experience, most likely from the standpoint of the participants. The researcher provided adequate description of the interpretation, as well as included verbatim quotations from the data gathered in order to support and exemplify the participants' interpretations.

Research Design

This study was a qualitative, exploratory case-study investigation. A case-study research is a form of qualitative inquiry that is suitable for a comprehensive and in-depth investigation of a complex issue in context. It is also recommended to answer why and how questions (Creswell, 2013; Stewart, 2014; Yin, 2014). Creswell (2013) suggested that ethnography, narrative, phenomenological, grounded theory, and case study are forms of qualitative research designs. According to Creswell (2013), a phenomenological study is used to describe the value of activity or event while grounded-theory study provides an explanation or theory behind the event. The narrative approach combines the sequence of events from one or two individuals to form an organized story. An ethnographical study involves the immersion of the researcher in the environment where the study is done in order to get firsthand experience of the culture and other facets of the study.

While these designs may have been applicable for this study, they could not provide an in-depth understanding of the problem as opposed to the use of a case study that employed multiple types of data sources (Creswell, 2013). Creswell also noted that

case-study approach was a good method to challenge theoretical assumptions. Another advantage of using this method was that it allowed the researcher to use multiple methods to collect and validate data. A case-study approach was also appropriate because the objective was to collect comprehensive perceptual data from contributors to provide an extensive understanding within a bounded system. It also allowed the researcher to have a clear and holistic understanding of the research problem (Baškarada, 2014; Yin, 2014). Teachers were also contributors to the data that were analyzed. The other methods previously discussed would not provide a detailed description of how teachers perceive the use of gamification on the academic performance of students on mathematics standardized test at the fourth and fifth grade levels.

A case study makes use of multiple sources of evidence for overall depth and breadth of inquiry. Interviews, observations, document review, questionnaires, and surveys constitute methods of data collection in this type of research. The study focused on the collection of data through interviews, field notes, and assessment data. Participants were required to answer open-ended questions and were not prompted, in order to get their explicit perceptions (Yin, 2014). Field notes were employed as a method of ensuring that beyond the work of the researcher, rich context persists. Phillipi and Lauderdale (2017) asserted that field notes are essential in a qualitative study to document information that is required in the context of the study.

Procedure

Following the approval for the study by the research committee (APPENDIX A) and the Institutional Review Board (IRB; APPENDIX B) the researcher contacted the school county seeking site permission. Approval by the school county was followed by e-

mail informing the principals that approval of the study had been granted. This e-mail included an attachment of the approval letter and the informed consent letter (APPENDIX C). These principals, upon the direction of the county official, were required to forward the e-mail to their fourth and fifth grade teachers. The consent form outlined details of the nature of the study as well as provided a link for teachers to complete the criterion questionnaire online. This criterion questionnaire was used to verify the teachers' eligibility to participate in the study (APPENDIX D). The consent form was also used to gain permission to record the individual interviews for future transcription. The researcher also met with these teachers to explain the nature of the study and answer questions, if needed. A purposeful sampling technique was used to select the participants. This technique was chosen, as these teachers have been living the experience.

Data were collected from interviews, field notes, and assessment data. The researcher interviewed the teachers on their perceptions on the impact of gamification on students' academic performance on mathematics standardized examinations. All interviews were recorded, transcribed, and reviewed for accuracy. The perceptions of these teachers were grouped into different themes and patterns. It was later triangulated to gain a comprehensive understanding of the phenomena (Carter, Bryant-Lukosius, DiCenso, Blythe, & Neville, 2014; Creswell, 2013). Assessment data in the form of pretest and posttest data were used as a method of validating the perceptions of these teachers. Ethical considerations were aligned with the policies of the IRB guidelines and procedures. The materials were stored securely and the participants' names, the institutions, and the county identification were all referred to with pseudonyms.

Instrumentation

Creswell (2013) and Yin (2014) indicated that instrumentation is the term used to describe the process of creating research instruments that are appropriate in collecting data in the study. They are tools or means by which the researcher endeavors to quantify the variables in the data-collection process. Instrumentation epitomizes the conditions under which the selected tools are administered. The tools in the research are referred to as instruments that are used to collect data. Interviews, observations, document review, questionnaires, and surveys are instruments that may be used to collect data in a case-study approach. The instruments that were employed in this study were individual interviews, field notes, and assessment data.

Creswell (2013), Baškarada (2014), and Seidman (2013) all stated that interviews are guided discussions that are usually one of the most important sources of case-study evidence. Interviews can be structured, semistructured, or unstructured. Structured interviews are built upon predetermined questions where the response categories are limited. On the contrary, unstructured interrogations are more flexible, and they do not facilitate redefined questions but instead utilize open-ended questions. A semistructured interview allows the researcher to change the questions. The researcher can also provide prompts to gather more information in the event of emerging thought trends that spark his or her interest. The interview for this research included semiopen-ended questions that allowed for a more comprehensive discussion as opposed to the other types of interview. It provided the researcher with an in-depth understanding from the participants by discovering gaps in the literature about gamification and mathematics instruction.

Field notes were the researcher's observation data and interpretation of the attitudes and behavior displayed by the participants during the interview process. Phillipi and Lauderdale (2017) suggested that field notes are the researchers' transcription of what they hear, see, experience, and think in the course of collecting and reflecting on the data. Phillipi and Lauderdale (2017) asserted that field notes are essential in a qualitative study to document information that is acquired in the context of the study. The authors suggested that field notes aid in ensuring that beyond the work of the researcher, rich context persists.

While other instruments could have been employed, field notes allowed this researcher to capture adequately, perpetuate, and discuss behaviors, reactions, the environmental contexts, and nonverbal cues that transpired during the interview (Sutton & Austin, 2015). Sutton and Austin (2015) noted that field notes provide an important framework for the researcher to interpret audio-taped data. In addition, field notes aid in reminding the researcher of evidential issues that may be important in the data analysis process.

Fautley and Savage (2013) posited that assessment data are information gathered to evaluate and determine students' learning outcomes as well as to inform the teaching and learning process. The authors noted that day-to-day assessment, periodic assessment, and terminal assessment are three types of assessment data. Day-to-day assessment is assessment data that the teacher frequently used in a classroom to inform future learning. This assessment data is important in planning for each individual student. On the other hand, Fautley and Savage (2013) asserted periodic assessment occurs occasionally. It

may be done as a test or to assess a lesson, but its main objective is to audit the learning that takes place.

Terminal assessment is more summative in nature. It may be done at the end of a unit, course, or term as well as other important times in the learning calendar. These assessments may be referred to as high-stakes assessments that are often used for auditing purposes. The type of assessment data that was used in this research may be classified as terminal assessment. These are standardized examination data that are used to rank school performance. They are also used to highlight gaps in learning that need to be resolved (Fautley & Savage, 2013).

Data Collection

The data for this study were collected through the use of individual interviews, field notes, and assessment data. Conforming to Creswell (2013) and Seidman (2013), the use of interviews in a qualitative method study is paramount in understanding the perceptions of individuals who are living the experience. The purpose of interviewing teachers was to gain a comprehensive understanding of the participants who have firsthand experiences of gamification and mathematics instruction.

The second phase in collecting data was the use of field notes. Phillipi and Lauderdale (2017) asserted that field notes are essential in a qualitative study to document the information that is required in the context of the study. Phillipi and Lauderdale suggested that field notes aid in ensuring that beyond the work of the researcher, rich context persists. The field notes were used to compliment the audio-taped interviews (Sutton & Austin, 2015).

The final phase in collecting data involved the use of students' assessment data. The students' academic data from fourth and fifth grades were collected to validate the perceptions of the teacher interview.

Individual Interviews

Seidman (2013) and Creswell (2013) both defined an interview as an individual's ability to signify his or her experience through language. A total of 12 elementary school teachers were interviewed. Dehkordi, Babashahi, and Irajpour (2016) and Latham (2013) stated that a minimum of 15 participates must be interviewed in a qualitative exploratory case-study design in order to achieve saturation. However, after conducting 12 interviews, the researcher stopped collecting data, having realized that the data had reached saturation. Face-to-face interviews were done using semistructured open-ended questions (APPENDIX E). The semiopen-ended questions were developed in relation to the research questions. Semiopen-ended questions allow for more comprehensive discussion that provided the researcher with a deeper understanding, from the participants, of the gaps in previous literature about gamification and mathematics instruction.

The interviews were conducted at mutually convenient times and places. This allowed the interviewees to feel comfortable and relaxed in voicing their opinions (Creswell, 2013). Prior to the interview, the participants were provided with an opportunity to ask any questions they had about the study. These participants were also given an opportunity to review the transcripts and provide feedback for any data that should have been eliminated or excluded.

The first two questions were constructed using textual and structural description, according to the views of Creswell (2013). These questions were geared toward capturing the teachers' perceptions on the use of gamification on mathematics instructions. Questions 3 through 5 were constructed with the view of capturing how and what elements of gamification they have used in their mathematics instructions (Creswell, 2013). The other six questions allowed teachers to share perceptions in relation to their attitudes and beliefs in using gamification. This allowed the researcher to gain an understanding of the perceptions of these individuals who have firsthand experiences (Creswell, 2013; Seidman, 2013). These questions were also formulated to gain further understanding of how well these teachers valued gamification in their mathematics instruction.

The other five questions allowed the teachers to voice their opinions on their experience using gamification in their mathematics instruction. These questions added to existing research (Appiah, 2015) on teachers' experience with using gamification in mathematics research. Questions 17 and 18 were constructed to gather information on any barriers that the teachers encountered with the use of gamification in their mathematics instruction. These questions were intentionally done at the end of the interview, based on the views of Patton (2015). Patton (2015) concurred that at this stage of the interview, a good rapport should be established between the interviewer and the interviewee. This allowed the interviewee to feel comfortable and reflective in answering the questions. The last two questions allowed the participants to provide a brief overview of their experience with gamification on mathematics instruction. At this stage, the teachers were required to express their sentiments on how gamification should be

implemented in mathematics instruction. This created an opportunity for them to represent themselves as experts in the field (Patton, 2015).

Filed Notes

Field notes were collected on the attitudes and behavior displayed by the participants during the interview process. Phillipi and Lauderdale (2017) asserted that field notes are essential in a qualitative study to document information that is required in the context of the study. Phillipi and Lauderdale suggested that field notes aid in ensuring that beyond the work of the researcher, rich context persists. The field notes were used to compliment the audio-taped interviews (Sutton & Austin, 2015).

Assessment Data

According to Dougherty (2015), assessment data are important in helping educators and school leaders to make informed decisions in meeting the needs of students. This will further extend to impacting positively the teaching and learning process. The students' academic data in the form of pretest and posttest from fourth and fifth grade were collected to validate the perceptions of the teacher interview.

Population

The research population consisted of teachers at the elementary level in North Carolina. A criteria questionnaire was used to select the teachers who participated in this study. Mandatory requirements included a minimum of three years' teaching experience and a minimum of one year's experience in using gamification. These teachers were selected from fourth and fifth grade in the area of mathematics. The population was composed of fourth and fifth grade teachers at two coeducational institutions. There are

three fourth grade and four fifth grade classes at one of the schools; the other school has four fourth grade and four fifth grade classes.

Sampling

Gay, Mills, and Airasian (2012) stated that qualitative sampling is the process of selecting a small number of individuals for a study in such a way that the individuals chosen will be good key informants and will contribute to the researcher's understanding of a given phenomenon. Data were collected from a sample of 12 teachers in two coeducational government elementary schools in North Carolina. The scope was restricted to two schools and their identities were held with the strictest of confidence in order to protect their privacy. A purposeful sampling technique was used to investigate the views of selected knowledgeable information-rich educators (Palinkas et al., 2015), who have firsthand experience on the use of gamification on students' academic performance on mathematics standardized examination. The criteria for these teachers to participate in the study included at least three years' teaching experience, one year's experience in using gamification, and they were teaching mathematics at the fourth and fifth grade level.

This technique emerged as a result of existing gaps in literature related to teachers' perception of gamification on students' success and academic performance in mathematics standardized examinations at the fourth and fifth grade levels (Dichev & Dicheva, 2017; Katmada et al., 2014).

Data Analysis Procedures

The criteria to ensure the quality of this research included validity and reliability. Leung (2015) cited that validity in a qualitative study refers the suitability of the tools,

methods, and data. In this research, validity refers to the fundamental honesty of the data. Reliability relates to researchers' claims in regard to the consistency of the information (Leung, 2015). To ensure the threshold qualitative characteristics of validity and reliability, the researcher believes it is imperative that the data collection process produces evidence that can withstand rigorous scrutiny.

Therefore, the source and quality of the data are key factors to ensuring such an objective. Data were collected from diverse sources using different data collecting strategies to achieve data saturation. Rostkowski and Singh (2015) as well as Dehkordi et al. (2016) defined data saturation as a method of data triangulation in which the researcher utilizes independent pieces of information. This information is acquired by conducting face-to-face sessions with decisive and diverse designated respondents. The aim of this diversity was to get a comprehensive understanding of an unknown incident. The data in this exploratory case study entailed assessment data as well as the personal views of elementary school teachers from two elementary schools.

Triangulation was the modus operandi and Charmaraman, Jones, Stein, and Espelage, (2013) and Leeuwis, Koot, Creemers, and van Lier (2015) theorized it will ensure the scope, complexity, and minimal bias are accomplished to foster validity; Triangulation involves the utilization of different independent sources of data to establish the validity and accuracy of a claim (Carter et al., 2014; Creswell, 2013). It was the approach taken to guarantee legitimacy and quality of the information gathered. Triangulation was utilized as a strategy for cross-checking data from different sources to analyze the irregularities in the information and to give a more definite and adjusted picture of the circumstances.

This researcher also used bracketing as a method of eliminating any personal judgements that may have emerged during the process. Creswell (2013) and Snelgrove (2014) asserted that bracketing is a qualitative strategy that allows researchers to ignore their personal experiences and view the situation from a new perspective. Thus, the researcher documented all personal experiences, judgments, feelings, and ideas of using gamification before conducting the interviews. This was done to ensure that the information was viewed from a new perspective. Once the interview was conducted, the researcher shared the transcript with the participants before analyzing the data to check for accuracy.

The interview and field notes were analyzed using narrative analysis while the assessment data were analyzed using descriptive analysis. Babin and Zikmund (2016) defined descriptive analysis as the basic conversion of data in a form that defines simple features of central tendency, distribution, and inconsistency. Loeb et al. (2017) defined descriptive analysis as simplification that has the capability to stand independently as a research product. On the other hand, narrative analysis, as defined by Creswell (2013), is a method of interpreting meanings of what is said in an interview into research text. Creswell noted that such analyses are transcribed experiences. The objective of narrative analysis is to reformulate the stories offered by the participants in the context of the study.

The interviews, field notes, and assessment data were analyzed in accordance with Creswell's (2013) and Snelgrove's (2014) views on data analysis. The researcher reviewed the transcript of each interviewee in the interest of becoming familiar with the data. In addition, the transcripts were read line by line to classify important testimonials

relating to the use of gamification in mathematics instructions (Creswell, 2013; Snelgrove, 2014). The next phase involved the creation of a table to tabulate the important testimonials. The table also introduced new concepts and subordinating themes conveyed from these narratives. The researcher then organized these themes to reflect consistency. Establishing these themes allowed the researcher to triangulate further the data into textual descriptions.

Validity of the Study

Validity refers to the truthfulness of the data (Creswell, 2013; Leung 2015). To ensure the validity of the study, the researcher used a combination of multiple methods to collect data to ensure triangulation. The methods included interviews, field notes, and assessment data. The researcher also used triangulation theory, through which more than one theoretical approach was used to interpret and support data. The researcher also used bracketing to eliminate any prejudgments and assumptions that could have impeded the data collection and data analysis (Creswell, 2013; Snelgrove, 2014).

Reliability of the Study

Reliability relates to the researchers' claims in regard to the consistency of the information (Leung, 2015). A method of ensuring credibility is having the participants review the transcript and the themes that may then emerge. The combination of multiple methods to collect data to ensure triangulation is also a method of ensuring credibility (Creswell, 2013; Snelgrove, 2014). This suggests that ethical issues were of paramount importance in order to have control of all subjects. Creswell (2013) and Snelgrove (2014) concurred that the use of three different data sources is paramount to validate the research

findings. The use of three different sources such as interview, field notes, and assessment data were used to validate the themes.

Ethical Considerations

Considering the nature of qualitative research, there are ethical issues involved in this study (Sanjari, Bahramnezhad, Fomani, Shoghi, & Cheraghi, 2014). The aim was to investigate the perceptions of teachers on the impact of gamification on the academic performance of students on mathematics standardized examination at the fourth and fifth grade levels. In conducting research, there should be respect for the welfare of the subjects who participated. To ensure that confidentiality of this research was maintained, all members of the sample group as well as the institutions within which the study was undertaken needed to have their privacy protected. The researcher, therefore, kept in absolute confidence the names of the participants and the institutions. The name of the county was referred to using a pseudonym. Members of the sample group were informed that their participation was voluntary. The researcher encouraged but did not oblige anyone to take part in the study.

The researcher has been a teacher in the county for more than two years; therefore, it was of utmost importance to refrain from having any bias or expectations in collecting and analyzing the data. In order to bridge this gap, the researcher was cautious throughout the process.

Summary

This chapter provided a detailed outline of the problem, purpose, method, design, population, and sample of the teachers involved. The researcher's plan described the data collection process and analysis, instrumentation, and procedures of data collection. The

criteria to ensure the quality of this research included validity and reliability. Data collection and analysis plans have been presented, as well as the ethical procedures.

Chapter Four of this study explains the analysis of the data that was gathered from the interviews, field notes, and assessment data as discussed in the methodology. The data were represented in a narrative form. The interpretations of the study results are presented in Chapter Five.

Chapter Four

Data and Findings

Overview

The purpose of this qualitative exploratory case study was to examine the perceptions of public school teachers on the effects of gamification on students' academic performance on mathematics standardized exams at the fourth and fifth grade levels. The participants of the study were 12 teachers from a school district in the state of North Carolina. The major themes that emerged from the data analysis are perception, attitude, instructional practices, students' learning outcomes, self-efficacy and professional support. In this chapter, the participants are described, the results are presented, the themes are explored, and the central and research questions are discussed. The chapter concludes with a brief summary of the results of the research and the lead to Chapter Five.

Participants

Participants were purposefully selected, but they volunteered after receiving e-mailed invitations to participate in the study. To participate in the study, participants had to have at least three years' teaching experience. They must also have had at least one year's experience with using gamification in mathematics instruction. The proposed sample was 15; however, after interviewing 12 persons, the writer stopped collecting data because the writer realized that the data was at a saturation stage. Fusch and Ness (2015) stated that the use of saturation in a qualitative research is a criterion for discontinuing data collection or data analysis. They asserted that failure to achieve saturation has an effect on the quality of the research conducted. All the interviews took place after school.

The participants included Grade 4 and 5 teachers who teach mathematics. Six of the participants were Grade 4 teachers and six were Grade 5 teachers. All participants in the study were contractual teachers working for the Davis County (pseudonym). Table 1 provides information about the participants' teaching experience and gamification experience. All participant names have been replaced with pseudonyms to ensure anonymity. All the participants held more than five years of teaching experience. The mean years of teaching experience for these participants was 11.67, which would equate to 12 years. The highest number of academic years of using gamification reported was five years and two years was the lowest. The mean academic years using gamification for the participants was 3.67, which would equate to 4 years.

Table 1

Participants Profile

Participants	Years of Teaching	Academic Years Using Gamification
Ameilia	16	3
Karen	16	3
Pam	5	3
John	18	4
Alley	8	3
Jess	15	5
Garcia	12	2
Rex	13	5
Jane	9	3

(continued)

Participants	Years of Teaching	Academic Years Using Gamification
Kim	10	4
Sher	7	4
Rose	11	5
Mean Years	11.67	3.67

Primary Data Analysis

The data were analyzed to reflect the common themes and patterns concerning teachers' perceptions on the impact of gamification on mathematics standardized examinations. Semiopen-ended interviews were conducted with 12 participants. Additionally, audio recordings and the responses from the interview were transcribed and coded for analysis using emergent themes. The raw data retrieved from each research question were captured and displayed later in this chapter.

Initial Coding Results

The transcript from the interview was thoroughly examined line by line to accomplish the initial coding of the data (Corbin & Strauss, 2015). Gläser and Laudel (2013) likewise Saldaña (2016) as well as Corbin and Strauss (2015) and Charmaz (2014) posited that line-by-line coding is an important technique for analyzing interview transcripts. Line-by-line technique involved applying codes to each line of qualitative data (Charmaz, 2014; Corbin & Strauss, 2015; Gläser & Laudel, 2013; Saldaña, 2016).

Line-by-line technique allows the researcher to delve deeper into the data and garner adequate and relevant information to formulate appropriate subcategories. These subcategories emerged as a result of classifying the codes into corresponding themes. The

corresponding themes were aligned to the research questions as suggested by Clarke and Braun (2013) as well as Saldaña (2016) and King and Brooks (2017).

Clarke and Braun (2013), Saldaña (2016), and King and Brooks (2017) asserted that thematic analysis provides opportunity for researchers to align important data with the research questions. This is significant in adding different layers of meaning to the data (Clarke & Braun, 2013; Saldaña, 2016). For example, if the participants suggested that students were motivated and their confidence level grew, it was categorized under the theme self-efficacy. Another example would be if the participants suggested that students' problem-solving skills or learning outcomes improved, it was categorized under the theme student learning. Clarke and Braun (2013) and King and Brooks (2017) credited the thematic analysis for allowing researchers to be flexible in providing authentic as well as comprehensive and complex accounting of the data. The numerous codes that emerged were categorized under various markers following the initial coding, as outlined in Table 2.

Table 2

Initial Coding With Markers

Markers		
Motivation	Active engagement	Centers-station activities
Confidence	Immediate feedback	Independent work
Improved problem-solving skills	Data-driven instruction	Persistent

(continued)

Markers		
Improved critical-thinking skills	Enriched learning environment	More comfortable
Improved learning outcomes	Personalized learning	Effective tool
Attentiveness	Differentiated instruction	Collaboration
Improved academic growth	Small-group instruction	Developed conceptual understanding
Disciplinary issues decreased	Whole-group instruction	Flexible grouping
Close achievement gaps	Rewarding	Lack of adequate resources
Social skills developed	Improved Retention	Makes learning fun
Developed independence	Formative assessment tool	Loved it
Student centered learning	Very hesitant	Frustrated
Provides flexibility	Very nervous	Hesitant
Characteristics of academic success	Reserved	Loved it
Developed lifelong skills	Fearful	Overwhelmed
Internet glitches	Excited	Skeptical
Better team spirit	Timid	Little confusing
Competitive	Scared	More Appreciative
More positive	It works, love it	Less Skepticism

(continued)

Markers		
More confident	More competent	More knowledge
Fear diminished	More comfortable	More empowered

The perceptions and experiences of the participants were further categorized from the initial markers into emerging subthemes. These subthemes were subsequently combined based on similar conceptual connotation. For example, rewarding and effective tool suggests similar connotation; therefore, they were combined and placed in the same category. Certain words or phrases that denote similar connotations were then characterized in the same subtheme. Once the subthemes were established from the codes, the researcher continued to analyze further the data and in so doing, the dominant themes emerged. Charmaz (2014) and Saldaña (2016) defined this type of coding as theoretical coding. Charmaz (2014) and Saldaña (2016) theorized that this approach is necessary to collate effectively all the data gathered. Table 3 contains some of the subthemes and categories as well as the dominant themes that emerged from the collation of data.

Table 3

Configuring Categories or Subthemes

Categories or Subthemes
Personal development
Emotional response
Improved academic skills

(continued)

Categories or Subthemes
Improved social skills
Active engagement
Behavioral influence
Enriched learning environment
Assessment
Facilitation strategies
Data-driven instruction
Lack of adequate resources
Staff development
Differentiated Instruction
Personalized learning
Social growth
Initial impression and final judgement
Academic success
Positive or negative reaction

Table 4 contains the key themes and subtheme Categories that emerged from the data.

Table 4

Theoretical Coding: Identification of Key Themes and Subtheme Categories

Key Themes	Subthemes
Student Learning	Improved academic skills Improved social skills Behavioral influence Academic success
Instructional Practices	Active engagement Enriched learning environment Assessment Facilitation strategies Data-driven instruction Differentiated instruction Personalized learning
Self-Efficacy	Personal development Social growth
Attitude	Positive or negative reaction Emotional response
Perception	Initial impression Final judgement
Professional Support	Lack of adequate resources Staff support

Results

The following questions were used to guide the study: How do teachers perceive the effects of gamification on fourth and fifth grade students' academic performance on mathematics standardized examinations? How do teachers perceive the implementation of gamification on students' success? The open-ended individual interview questions were developed to elicit responses that would answer these central questions. Using a thematic approach to data analysis (Creswell, 2013), the following six major themes were developed from the study, including perceptions, attitude, instructional practices, learning outcomes, self-efficacy, and professional support.

Based on the many reflective statements made by the participants, the first two key themes emerged, namely the teachers' attitude and their perceptions. These statements entailed descriptive accounts outlining their emotions and thoughts before and after the use of gamification. The theme instructional practices was derived from the statements that accounted for students' and teacher's interaction with gamification. Student learning and self-efficacy emerged based on teachers' account of the impact of gamification on their instruction. The final theme professional growth developed as a result of statements made regarding the training and resources received.

Theme 1: Attitude

A keen analysis of the data led to the emergence of two subthemes. They were: (a) Positive or negative reaction, and (b) Emotional responses. These subthemes materialized out of significant statements made by the participants, which helped the researcher to group them under this theme. Most, if not all, of the participants used descriptive words to provide a comparative account of their emotions with gamification.

Of the respondents, nine, or 75%, stated that they did not embrace the use of gamification at the initial stage of its introduction. They were of the view that the implementation of gamification in their mathematics instruction would have taken away from their instructional time. The respondents also thought that students would not be focused, and they would probably be losing out academically.

The respondents noted that after using gamification over time and witnessing the benefits of it, the negative attitudes they had no longer exist. They believed that gamification allows them to have a more structured classroom setting. It was noted that gamification allowed teachers to be more flexible in the classroom and it has benefited the various tiers within the classroom. Gamification in mathematics instruction is a very rewarding and effective tool in providing differentiated instruction, as suggested by all the respondents. All nine respondents agreed that students are enthused, very attentive, and very engaged and, as a result, the students' performance has been enhanced. They also noted that students are more motivated, there is a greater level of conceptual understanding, and students' attitude toward mathematics has changed in a positive way. There are less disciplinary issues to focus on whenever gamification is involved in the lesson, as pointed out by the respondents. These nine participants voiced that they are more appreciative of gamification as a pedagogical tool as well as more comfortable using it after realizing the benefits that can be derived from using it.

On the other hand, three, or 25%, of the respondents verbalized that they embraced gamification when it was first introduced to them. These respondents attributed this gesture to their personal experience with games. These respondents assumed that gamification would help students to learn concepts without them even realizing that they

are really learning. They also found it to be refreshing knowing that it is a pedagogy that can be incorporate in every instruction.

Based on the data, the attitude of the teachers about gamification in mathematics instruction was more positive than negative. It was clearly stated in the interview that fear factors existed among 75% of the participants while the other 25% embraced and easily adopted to using gamification. It is noteworthy that those fear factors have diminished gradually, and they have a more positive attitude toward the use of gamification in their mathematics instruction. Table 5 outlines the comparison of teachers' attitude toward gamification.

Table 5

Comparison of Teachers' Attitude Toward Gamification

Participants	Initial Attitude	Attitude Now
Ameilia	Hesitant	More positive and appreciative
Karen	Very nervous, very hesitant	More confident
Pam	Reserved	I feel good as a teacher.
John	Fearful	Fear diminished, more confident
Alley	Excited	It works, love it.
Jess	Timid	More confident and appreciative
Garcia	Scared	More comfortable
Rex	Loved it	More empowered
Jane	Hesitant, nervous, frustrated	No longer frustrated, hesitant, nor nervous but more appreciative

(continued)

Participants	Initial Attitude	Attitude Now
Kim	Loved it	More confident and competent
Sher	Skeptical	I no longer have any skepticism.
Rose	Little confusing and overwhelmed	More confident, more knowledgeable

Theme 2: Perceptions

The participants expressed that gamification is a very effective and useful tool that can be used in the discipline of mathematics. The majority of the respondents articulated that they found it to be very rewarding. Their students are enthused, very attentive, and very engaged and, as a result, they find that their performance have been enhanced. The respondents also believed that gamification in their mathematics instruction boost students' interest level as well as their academic outcomes and it's just a different way to have students engage without always hearing the teacher. Gamification in mathematics provides a better opportunity for students to review previously taught concepts and learn new concepts.

Of the respondents, eight, or 67%, also shared that the use of gamification in mathematics is more effective on motivation and students learning outcomes as opposed to the traditional method of teaching. They believed that gamification allows them to have a richer classroom environment and that students are more empowered to learn. That students are more empowered to learn, they opined that a lot more learning and conceptual understanding takes place. They retorted that gamification allows their mathematics classes to be more interactive and allows students to become more confident in the subject.

These eight respondents perceived that gamification allows them to meet better the needs of more students, as it is more student centered as opposed to the traditional classroom approach. They expressed that gamification takes the teacher away from the forefront and allow students to explore better mathematical concepts. The respondents voiced that they are better able to collaborate with their students because of the immediate feedback, which is being provided. One of the respondents established that the level of collaboration that gamification provides allowed students to develop better sportsmanship and appreciation for fellow classmates who won and are basically their opponents.

All 12 respondents noted that gamification works very well with their subject frameworks and it is very much aligned with the Common Core standards. All 12 respondents agreed that gamification is well aligned with Common Core and fits in perfectly; it allows them to be more flexible in meeting the standards. That students are enthused about learning makes it easier for the teachers to go through the standards. The majority of the respondents noted that most of their assessments are done online as opposed to students completing paper and pencil assignments. They also reported that they are better able to differentiate students' assessments and better prepare them for the end-of-grade test that they will be doing. All of the respondents held the perception that gamification is easily aligned with Common Core. It doesn't take away from the core subject or the standard alignment because whatever they are teaching is easily facilitated through gamification. The respondents also expressed that the use of gamification in mathematics instruction has a positive impact on students' ability to retain previously

taught concepts. They noted that gamification allows them to be more flexible in focusing on standards that students are weak in, thus, closing achievement gaps.

In sum, the general perceptions uttered by the teachers was that gamification enhanced their instructional practices by allowing students to be more collaborative because it is an effective pedagogical tool. There were no suggestions or recommendations for the abandonment of gamification in mathematics instructions. However, suggestions were made for it to be implemented in all subject areas. More than 60% of the respondents expressed that it is the best way forward. Figure 1 summarizes teachers' perception.

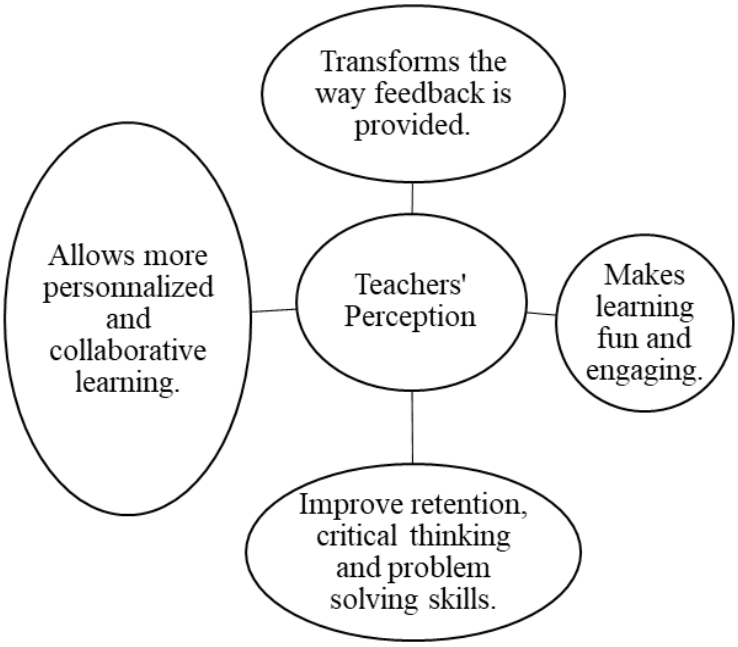

Figure 1. Teachers' perception

Theme 3: Instructional Practices

The shared experiences of teachers' use of gamification in their mathematics instruction was manifested through their communication in how they use it in their classrooms. This theme highlighted the teachers' perception about the use of gamification

in mathematics instruction. This theme emerged as a result of the substantial statements made by each participant during the interviews. All 12 respondents expressed that gamification can be used in all aspects of their lessons. They communicated that they used it for introductory activities, whole-group instructions, individual work, as well as centers and station activities.

The respondents shared that gamification helped their students to absorb better and retain mathematical concepts. Gamification also allowed them to provide a greater level of differentiation to students. They cited that the instant feedback is very useful in providing more rich and authentic data to drive instruction and close achievement gaps.

All 12 respondents agreed that gamification is well aligned to the Common Core standards that they have to teach. The majority of the respondent noted that they are privy to ongoing training and they receive a lot of in-house professional development sessions. Whenever these sessions are held, administration gives them an opportunity to pair up into groups to learn about other strategies that other teachers are using. This is where most of these gamification tools are introduced. These tools are easily adoptable to meet the objectives of the Common Core standards. It was also noted that one of the Common Core standards in Language Arts requires students to be able to use technology and also create their own games on the computers. They are also expected to compete with each other on their own created games.

The general consensus echoed by the participants in regard to delivery of the content with the integration of gamification was that the content remained the same while the delivery changed. It was also noted that especially with Quizlet live, students are grouped randomly instead of giving students the option to choose their teammates. This

allowed reserved students to become more collaborative and participative. The majority of the respondents agreed that teaching and instructing is done first because the students will have to learn the content first, as well as become aware of the different strategies they can use. After they have learned the content and strategies, then gamification is used to assess their knowledge of the content.

It was also highlighted that this data is used to create flexible groupings for future classes. More than 50% of the respondents asserted that they changed the amount of times that assessed students. Instead of doing a summative assessment they now give a preassessment and postassessment. This way they can visualize what else students need other than just giving them an assessment. The responses from the respondents revealed that most formative assessments are done online as opposed to with paper and pencil. On the other hand, students still have to complete the same Standard Mastery Assessments and benchmark tests, which are required by the county.

All 12 respondents agreed that the use of gamification has allowed them to be more flexible in assessing students based on content covered. Gamification allowed them to differentiate better their assessment of the content. More than 60% of the respondents mentioned that their assessment of the content has changed to allow for a more personalized learning. They are better able to meet the needs of their students. The general consensus of the participants is that the instant feedback feature of this tool allows them to use data to drive their instructions.

Data received from these tools are used to remediate and reteach standards in which students are not proficient. Since most of the assessments are done online because of the immediate feedback that these tools provide, teachers are better able to make the

necessary adjustments in a timely manner to meet the needs of students. A typical example given was when students are given a quiz on Quizizz, at the end of the game, the teachers are able to see which questions students were struggling with based on the percentage on that particular question. It also shows the accuracy percentage for the class. This way teachers can provide remediation whether in whole groups or small groups. A brief synopsis of the teachers' instructional practices is outlined in Figure 2.

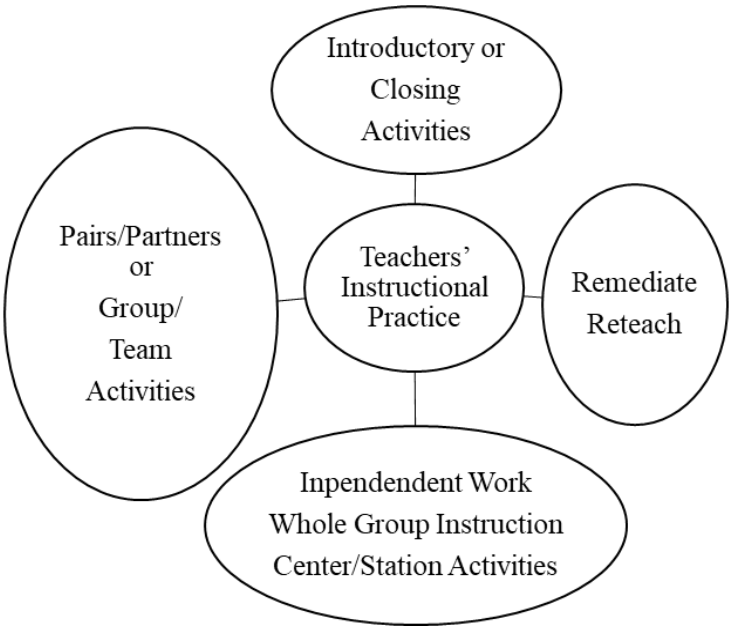

Figure 2. Teachers' instructional practice

Theme 4: Learning Outcomes

This theme emerged as a result of the statements made by the respondents during the individual interviews. The sentiments echoed by the respondents revealed that the use of gamification in mathematics instructions impacts different areas of students' learning. Evidence of this impact has been noted in students' engagement, motivation, collaboration, less disciplinary problems, accountability, and academic performance.

The respondents expressed that they have less disciplinary problems to grapple with whenever they use gamification in their mathematics instructions. They believed

that this allowed for the class to achieve the learning expectations. More than 50% of the respondents mentioned that gamification eliminates the distraction that students encounter, fewer behavioral problems exist, and the students are more focused on the assigned task. They believed that because students are meaningfully engaged, there are fewer disciplinary problems with which to contend.

The participants believed the use of gamification in mathematics instruction helps students develop better conceptual understanding. Asked about gamification's impact on students' learning, the respondents noted these gamification tools help motivate students. They believed when students are motivated, they try harder, which contributes to developing conceptual understanding. It was communicated that students were able to perform better on tests because of the level of conceptual understanding they developed.

Gamification is a great pedagogical tool to improve students' retention skills, as professed by the transcript from the interview. All 12 participants communicated that these gamification tools can be used to provide spiral reviews that help students to better retain concepts. They shared that through the use of these games, students have been able to make better connections to the content and are better able to retain them. These participants believed that this retention helps students to perform better in the subject. It was also mentioned that gamification allowed students to become more fluent with their multiplication tables. They were also able to apply their multiplication tables to other mathematical concepts. All the participants expressed that they have seen real growth in terms of students' grades, learning outcomes, thinking, and their depth of knowledge.

The use of gamification does not only positively impact students' academic performance, but also help to develop lifelong skills. The theme lifelong skills emerged

as a result of significant statements echoed by the participants. More than 60% of the respondents suggested that students are also developing certain skills that are preparing them for life. They believed that students' social skills have improved where they tend to work better in pairs and even groups without fussing at each other. These respondents also stated that they recognized that students' team spirit developed more, they display better appreciation for good sportsmanship because they have to understand that their team might not be the winning team, but they have developed those skills. Some other life skills the participants voiced include cooperation, collaboration, and good team spirit.

The theme element of engagement was also communicated by all the participants. About 50% of the respondents shared that some students were easily distracted; however, with the introduction to gamification, they are more meaningfully engaged, thus they are more focused. All the respondents agreed that students have become more persistent and independent learners and aim to solve problems correctly. This they believed positively impacts students' understanding of concepts and test scores.

Theme 5: Self-Efficacy

Self-efficacy emerged as a significant theme when using gamification methodologies. All 12 respondents stated students were more motivated to participate in class activities as well as displayed higher interest levels in learning of mathematical concepts. They also shared that students displayed higher confidence levels than in a traditional classroom setting. More than 60% of the respondents shared that students became more confident in the subject; even those who were very reserved became more participative in class. The respondents conveyed that the level of confidence displayed by their students led them to take more risks in learning new concepts. They voiced that the

gamification helped to eliminate fear factors that students had for mathematics. Students felt more comfortable to ask questions without the fear of being embarrassed. The respondents stated gamification helped students develop a more competitive attitude, which led them to become more desirous to participate in problem-solving activities.

The respondents asserted using gamification in mathematics instruction helped students become more independent learners. They added that since students are rewarded to solve problems correctly, they make concerted efforts to solve the problems independently. It was mentioned that students prefer to solve problems independently for the sole purpose of being the winner. The students' success must be celebrated in tandem with the teachers' contribution. The roles that both parties play is of great importance. With this improvement in student performance and self-efficacy, teachers will ultimately need continuous development with this instructional strategy. The word cloud in Figure 3 provides details of gamification on students' self-efficacy.

Figure 3. Word cloud of students' self-efficacy

Theme 6: Professional Support

All 12 respondents indicated that they have had some formal training on the use of active engagement tools via the county. The majority of the teachers shared that they are continuously engaged in professional developments sessions, as well as they liaison with other colleagues. The respondents are also engaged in ongoing research; they believed that engaging in ongoing research provides them with opportunities to keep abreast with emerging technological tools, which can be used to gamify their classrooms. On the other hand, three of the respondents suggested that the county should be more consistent in providing more professional development sessions for such an effective pedagogical tool. They believed that the county should also provide the necessary and adequate resources to implement it.

The respondents all noted that professional development for gamification is important. Respondent 5 expressed that the provision of professional development sessions would help in getting more ideas on how to gamify better the learning environment. All of the respondents believed that professional development for gamification should be a continuous process because knowledge is increasing daily and teachers would feel more comfortable in using these tools to enhance the learning process. The respondents believed that using the same methods will become obsolete. They echoed the sentiments that these professional development sessions aid in making them more rounded as a teacher.

The majority of the respondents suggested that research-based tools should be used, and teachers should engage in ongoing research to improve their pedagogy. They retorted that this would be ideal to meet their needs and effectively impact their learning,

especially in trying to close achievement gaps. In conducting these professional development sessions, the respondents suggested they would benefit significantly from knowing the pros and cons of these tools.

The transcript from the interview provided substantial information that conveyed that the effective use of gamification has a positive impact on students' success. This positive impact gamification has on students' success was evident in their academic performance and social skills. The extent of this success supersedes the classroom environment, thus, traversing to lifelong skills, which are 21st century necessities.

Analysis of Assessment Data

Figure 4 illustrates the data with the average performance of 12 classes that employed the use of gamification as a teaching and learning technique. The sample comprised 10 females and two male staffers. Although the scores were clustered around the mid-50s, there were noticeable outliers. The highest average performance of a class was 83 while the lowest average performance was 38.

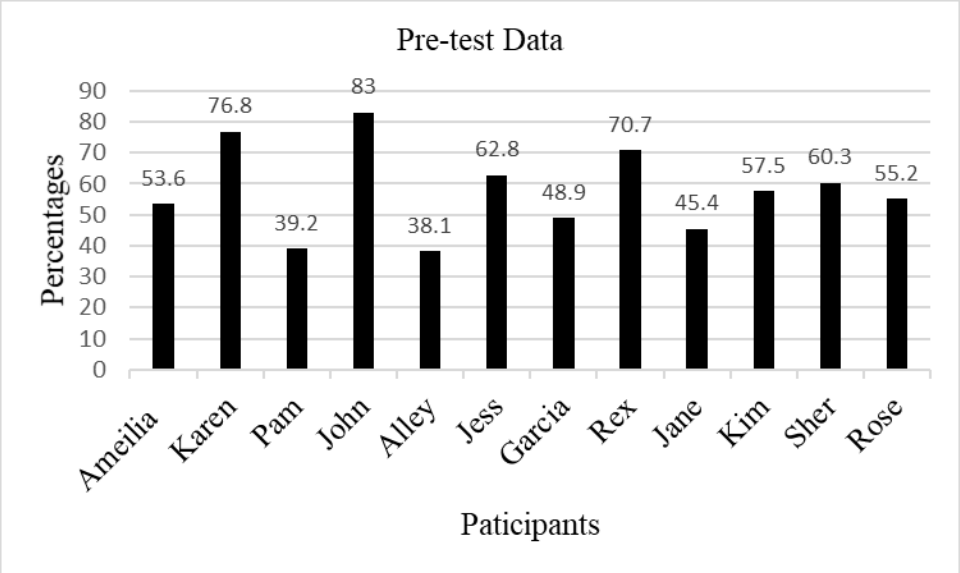

Figure 4. Bar graph displaying pretest data

Other variables that may have impacted the average performance of the various classes were controlled to ensure the accuracy of the data collected. These include class sizes, as well as, the time of day the test was administered. The mean performance of the classes was 57.63%. This represents an average score that is slightly above par, as outlined by the standards set by the school district. Two of the three highest sets of scores recorded were for male teachers. The researcher posits that gender could have been a factor affecting these preliminary high scores.

Figure 5 shows the results obtained from the posttest. These results were obtained after the use of the gamification. From observation, the majority of the scores are clustered around the high 70s and 80s. The use of gamification in mathematics instruction reflected increase in both averages for males and females. This means that gender did not play any impacting role on the use or outcome of the treatment. The mean performance among the 12 classes showed an increase of two grade levels. This means that a class that initially had a grade of D moved up to a B after the application of the treatment. The minimum average performance on the posttest was 65 while the maximum average performance was 93. The use of gamification in mathematics instruction created a more compact cluster of scores, thereby eliminating the outliers that were evident in the pretest. The mean performance for the posttest was 82.4%.

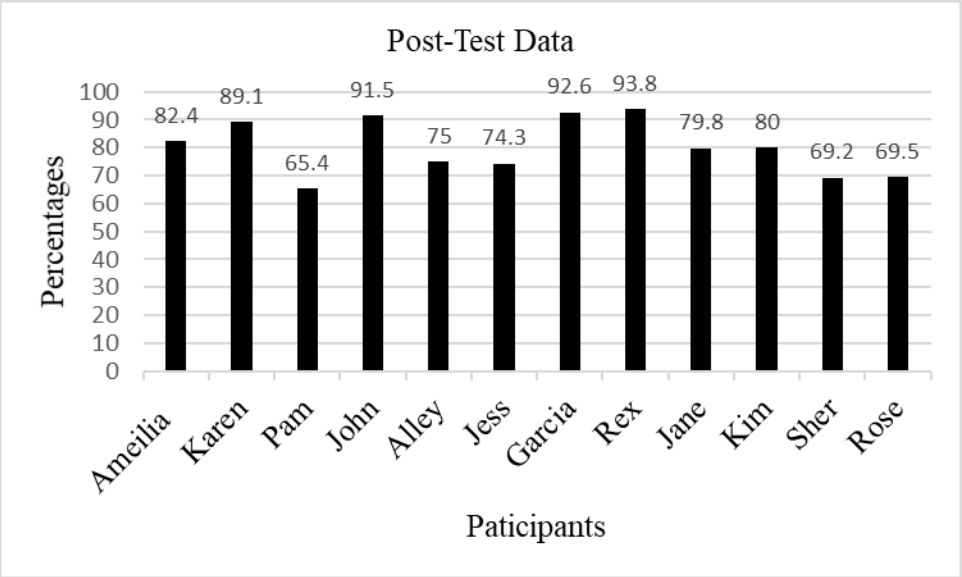

Figure 5. Bar graph display posttest data

Triangulation

Figure 6 represents the data from both the pretest and posttest. The data from both tests, along with the teachers' perceptions, illustrate that gamification was a useful tool in mathematical instruction. When a sample of academic professionals was initially interviewed, the response to the use of gamification was not all favorable. Of the respondents, three, or 25%, showed enthusiasm and eagerness to implement the strategy with a view that it would improve student's outcomes in the course. On the other hand, nine, or 75%, of the respondents expressed skepticism or held a negative perception toward the use and effectiveness of the strategy when it was first introduced to them.

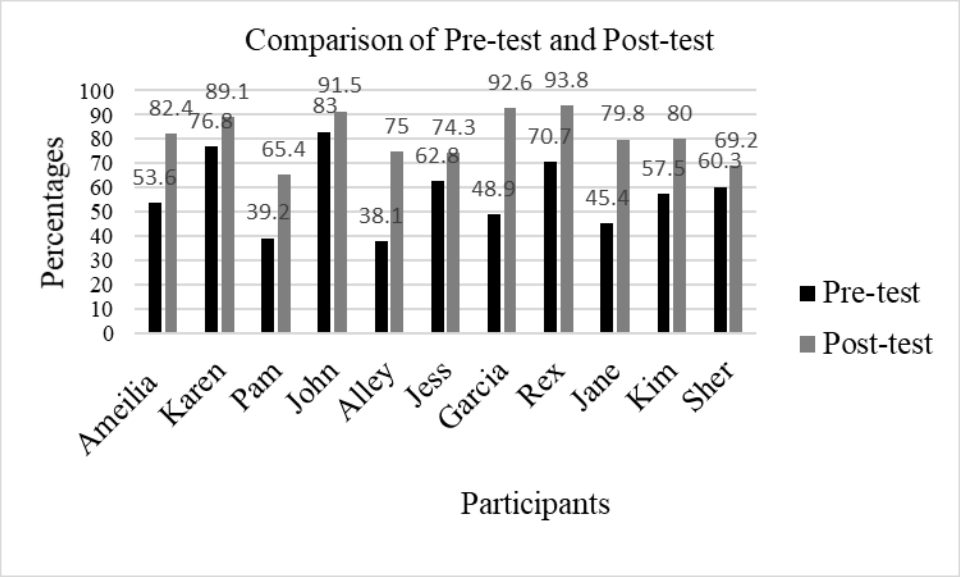

Figure 6. Bar graph comparing pretest and posttest data

These nine respondents were skeptical as to whether the use of gamification could be integrated into mathematics to impact student's outcomes. However, over time, as the strategy was implemented and its impact on students' performance became more evident, even the skeptics started to believe in the strategy and its effectiveness. One of the sample respondents posited that implementing such a strategy would be a waste of instructional time.

The students' performance in mathematics was generally low, as is reflected in the pretests scores. Of that sample, 58% were recording below average and failing scores in mathematics. This is more than one in every two students. Less than 40% of the sample had classes that were making a passing grade. The highest class average was a letter grade of B. Only two other classes showed a passing grade of C during their pretest assessment. For a subject as critical as mathematics, this was a significant number.

However, after the use of gamification, all classes came within a passing average. Instructors credited the success to the use of the strategy.

Of the instructors, three, or 25%, welcomed any opportunity to improve the scores. One of the three respondents who welcomed the opportunity to improve students' scores noted that her students experienced challenges in numeration and computation of numbers. She believed that any opportunity to get students more involved in the learning process could be beneficial to them. It was found that students were very fearful of math in general, as well as with their multiplication tables. Students did not know their tables when they started in August. However, after the using the strategy, all students became competent with the use of their multiplication tables. They were able to apply their tables to any math concept that they were learning. This improvement was credited to the effectiveness of the strategy. Evidence of this effectiveness was visible when the pretest and posttest data were compared. The average score obtained by this respondent's class in the pretest was 53.6% and 82.4% in the posttest. This shows an overall improvement of more than 28%.

Having implemented the strategy, the other nine respondents who were skeptical about gamification recorded even more significant improvements in student's average performance. One participant, who was scared to try a new strategy in mathematics, believed incorporating gaming could be challenging since it was something she had never done. Ironically, this respondent recorded the highest margin of improvement between the pretest and posttest scores. In the pretest, the students' average performance was 48.9%. After the use of the strategy, the posttest results showed an average of 92.6%. This reflects an increase in average performance of 43.7%, the highest from the sample.

This is significant numerically, but it also demonstrates that once teachers are willing to apply new strategies to teaching, they are likely to see changes in students' performance.

It was also posited that gamification is useful in that it allows students to take control of their own learning and become more actively involved in the learning process. This active involvement not only serves to boost their confidence, but it heightens their interest as well. The belief was advanced that when students are more interested in what they are doing, they are likely to perform better overall. This was evident in the average performance of the students. One class recorded an overall increase of 23.1% between the pretest and posttest scores. This is one of the highest increases recorded from the sample. With this significant margin of increase, there is no doubt that gamification can be an effective tool in mathematics instruction.

Standard deviation can be used in many ways. The chief way it is used is to show how far away a group of numbers are from the mean. Generally, a higher standard deviation means that scores are widely spread from the mean. However, a lower standard deviation means that scores are closer to the mean of a set of data. In the sample pretest, the standard deviation was 14.09. This means that the students' performance fell within 14 points of the mean, which is 57.63.

The posttest, on the other hand, showed a standard deviation of 9.48. This was significant when combined with the mean being much higher for the posttest. Despite this higher mean of 79.75, a standard deviation of 9.84 means that after the use of gamification, scores in the posttests fell within 9.84 points of the mean performance of 82.4.

The lowest margin of increase was 8.5%. Although a small increase, it still moved the students' average performance up one letter grade based on the standards of the independent school district. Additionally, though the margin of increase was only one letter grade, the use of gaming has aided students in other aspects of the teaching and learning process. For example, students have demonstrated greater interest in participating in all class activities. The respondent claimed that students showed more eagerness to participate in mathematics. The initial fear was that students would not be able to remain focused during the gaming process and, as such, would not benefit academically from the process. The strategy was lauded for helping students to develop better sportsmanship, as well as team spirit, which are lifelong learning skills. The respondents hailed the strategy for its usefulness in assisting students to develop other nonacademic skills. Chief among them was motivation. Students were highly motivated and in turn, motivated others to be more participative in Mathematics classes. Even students who were reluctant in problem-solving activities started to engage in deeper problem solving, which improved their critical-thinking skills. This extended to the point where they started creating their own activities.

Students also demonstrated creativity in problem-solving activities. They were able to transfer their knowledge to other concepts and used them to solve more complex problems. When students are able to transfer their knowledge from one discipline to another, this can only yield positive results.

Findings

This chapter provided a detailed account of teachers' perception of gamification in the discipline of mathematics. Having critically assessed all the details associated with

the samples, the researcher is led to highlight that gamification can positively impact students' academic performance in mathematics, as was suggested by Appiah (2015), Katmada et al. (2014), Afari et al. (2013), and Trinter et al. (2015). Gamification is perceived as a highly integrative pedagogy for both instruction and assessment. The instant feedback of students' performance is useful on evaluation, as well as producing instructors with the information they need to improve or modify their instruction to close existing achievement gaps.

All 12 respondents noted that gamification not only positively impact students' academic success, but it also impacts their nonacademic success. This was confirmed by Nicholson (2013) likewise Garland (2015) as well as Miller (2015), who believed that gamification positively impacts students and helps them learn lifelong social skills that transcend beyond the classroom. Nicholson (2013), Garland (2015), and Miller (2015) noted that these are relevant to function in the 21st century. Some of the skills that were noted are teamwork-collaboration, better sportsmanship, risk taking, problem-solving skills, motivation, perseverance, confidence, and critical-thinking skills.

Katmada et al. (2014) and Zakaria et al. (2013) identified mathematics as one of the least favored subjects by students at all levels of schools in America. On the contrary, gamification aids in eliminating fear factors that students had for mathematics and allowed them to take risks in trying new and challenging things (Dicheva et al., 2015). The competitive features of gamification motivate students to view learning as fun and engage in risk taking and problem-solving activities (Kapp et al., 2013).

More than 60% of the participants suggested that gamification was also effective in keeping students actively engaged in the learning process, thereby reducing

disciplinary issues. Appiah (2015) confirmed that gamification can be a valuable means of promoting behavioral changes and encouraging preferred attitudes in students. It was very apparent from the findings that because of the extent of interactivity in gamification, it facilitated a more student-centered learning environment. Tobias et al. (2014) agreed that the use of gamification in education helps to make the learning experience more meaningful and interactive.

Summary and Lead to Chapter Five

The purpose of this qualitative exploratory case study was to examine the perceptions of public school teachers on the effects of gamification on students' academic performance on mathematics standardized exams at the fourth and fifth grade levels. Analysis of the teachers' perception with integrating gamification in mathematics instructions developed six major themes. The teachers' perceptions were found to be common across themes that emerged. These included teachers' perception, attitude, instructional practices, self-efficacy, students' learning, and professional development.

Similar attitudes were displayed by the participants in their perception of gamification in mathematics instructions. There were some participants who were adaptable at the initial stage while others were either nervous, skeptical, timid, or fearful. These negative attitudes and perceptions gradually diminished, and they gained a more positive attitude and outlook as the time progressed. Shared experiences were expressed in relation to the participants' instructional practices. These were evident in aspects of transforming teacher-centered classrooms to more student-centered classrooms. Lessons are more personalized and differentiated.

The most common types of gamification tools used are Kahoot, Quizizz, Quizlet, and Sorative. Gamification has been evident in all aspects of their teaching instructions such as whole group, small groups, independent work centers and station activities, and introductory activities. The general consensus shared is that gamification is an effective assessment tool that provides authentic data to drive instructions. Students either worked independently, in groups or teams, or as partners, depending on the assigned task. The general sentiments echoed were that gamification allows students to be more motivated to learn mathematical concepts and apply their knowledge. There is a greater appreciation of the subject and learning is more fun. This is reflective in their academic performance, which has improved significantly.

It was evident from the teachers' perceptions that a good classroom structure be in place because of the level of excitement that students display when they are immersed in this environment. Some of the participants noted that they encounter difficulty having adequate laptops to engage students in the learning process. They also shared that they had connectivity issues. However, they asserted that they have no reservation in recommending gamification to their colleagues, as well as school systems looking to implement it in their curriculum. They believe it is a necessity and the benefits of using it are worthwhile. They retorted that school systems should provide adequate resources and training to impact positively the learning process.

Chapter Five of this study is divided into three sections: conclusions, recommendations, and summary. It entails a discussion on each research question and summarizes the results and themes discovered. Recommendations are made for practical implications and future research. The purpose of this chapter is to present an overall

analysis and interpretation of the findings in the study and to recommend areas for additional research.

Chapter Five

Summary, Conclusions, Discussion, and Recommendations

Overview

This chapter is divided into two sections. The first section outlines the summary of the study, followed by conclusion and further discussions. The second section of this chapter entails recommendations and implications. This chapter concludes with a summary.

Summary of the Study

The purpose of this qualitative exploratory case study was to understand how teachers perceive the effects of gamification on students' academic performance on mathematics standardized exams at the fourth and fifth grade levels. The lack of qualitative research regarding this model as a pedagogical tool was a cause for concern. In addition, there was inadequate knowledge on how teachers perceive the effects of gamification on students' academic performance on mathematics standardized examination. This research has provided vital qualitative data demonstrating the effectiveness of gamification in the area of mathematics.

The second chapter of this research focused on literature relating to standardized testing and gamification in mathematics instruction. It provided detailed information on the history of standardized testing, benefits and criticisms of gamification, as well as other theories relating to gamification and mathematics instruction.

Chapter Three of this research highlighted the methodology and research design. It provided detailed information outlining the research plan, the selection of sites, and

participants. Policies and guidelines for protecting the privacy of the sites and participants was also outlined in this chapter.

Chapter Four of this study focused on data analysis. The data were analyzed and triangulated into themes and patterns relevant to the research questions. The first section of the chapter highlighted the data collected from the interview, followed by the assessment data. The last section of the chapter focused on triangulation of both sets of data.

The final chapter of this study focuses on analysis and evaluation of the findings in relation to the two research questions that guided the study. It also provides detailed information on the implications of this study as well as recommendations for future studies.

Conclusion and Further Discussion

Lister (2015) postulated that previous, studies have shown mixed results on the use of gamification in education. Multiple studies have been conducted to ascertain the usefulness of gamification and its effects (Abramovich, Schunn, & Higashi, 2013; Banfield & Wilkerson, 2014; Gibbons, 2013; Hakulinen & Auvinen, 2014). The researcher discovered that limited studies have noted the perceptions of teachers using gamification in mathematics instruction at the fourth and fifth grade levels. Adding to other existent bodies of research, the current findings from this study indicated that the use of gamification as an instructional tool enhanced students' performance in mathematics.

The main sources of data that were analyzed included interviews, field notes, and pretest and posttest data. Two research questions guided this study:

1. How do teachers perceive the effects of gamification on fourth and fifth grade students' academic performance on mathematics standardized examinations?
2. How do teachers perceive the implementation of gamification on students' success?

The researcher employed different analytical techniques in a bid to address the research questions. A summary to the findings of each research question is outlined below.

Research Question 1

Gamification was initially viewed by the sample population as likely to have a negative impact on the academic outcomes of students. It was seen as a time-wasting venture that would distract students from meaningful academic performance that could be accomplished through other means. This position is consistent with previous research. Arnold (2014) posited that merely adding a system of gaming with badges and rewards is not enough to improve students' performance in any discipline. This view was further shared by Hamari (2013). Hamari stated that students' might easily become preoccupied with gaining points instead of any meaningful learning.

Of the participants, nine, or 75%, had a change of attitude and perception after gaining firsthand experience with the use of gamification. The negative attitudes and perceptions gradually changed from negative to positive ones. The perceptions held by these participants suggest that there is a positive correlation between gamification and students' performance in mathematics on standardized examinations. This positive correlation emerged as a result of its potential to provide more personalized and student-centered learning. Dicheva et al. (2015) agreed that gamification offers more

personalized and student-centered learning as opposed to the traditional approach to instruction, which is ineffective.

Gamification aids in developing students' conceptual understanding and problem-solving skills, which directly impact students' performance. Afari et al. (2013) likewise Trinter et al. (2015) agreed that students' mathematical or arithmetic skills as well as mathematical instructions, conceptual understanding, and problem-solving skills can be improved through the use of games.

Gamification motivates students to learn and think critically. This is supported by Jagušt et al. (2017) likewise Kiili et al. (2015), who suggested that the use of gamification has significantly contributed to student's motivation, mathematical achievements, and problem solving. In a similar vein, Chin and Zakaria (2015) found that games have been successful in improving students' number concepts and number operations skills.

Gamification is an important formative assessment tool, as it can be used to provide instant feedback, which is a key attribute of data-driven instruction that can be used to close achievement gaps. Kapp et al. (2013) offered that the use of gamification helps to bridge achievement gaps through features of the games that incorporate immediate and frequent feedback. Dicheva et al. (2015) agreed that the use of instant feedback allows students to feel more comfortable to take risks in trying new and challenging things.

Gamification allows students to be more meaningfully engaged and learn concepts more effectively. Freeman et al. (2014), Laursen et al. (2014), and Bressoud and Rasmussen (2015) asserted that active engagement techniques allow students to learn mathematical concepts more effectively and improve their academic performance.

Katmada et al. (2014) concurred that mathematical games appeal to students' interest and help in establishing better learning environments. The findings of this research indicate that gamification is an effective active engagement tool that can be used to improve students' academic performances in mathematics.

Research Question 2

The measure of a student's success is not limited to academics. Gamification also impacted students' social wellbeing, as well as lifelong skills such as social interaction, collaboration, perseverance, comradery, confidence building, motivation, independence, problem solving, and critical-thinking skills. Miller (2015) agreed that gamification connects better with students' expectations and 21st century skills. Students' desire increased motivation and interaction in their learning environment. This motivation and increased participation were facilitated by the use of gamification. The findings of this research are synonymous to Miller (2015) assertion that gamification depicts subject-based knowledge, teamwork, systems thinking, collaboration, media literacy, epistemological theories, and critical-thinking skills. These are important skills that help to equip students to meet the demands in the current era.

Miller (2015) cited that gamification as well as elements of games exemplify the skill sets that support the 21st century generation of students; thus, having a greater impact on the production of the educational system. The ideas put forward by the Miller suggested that gamification connects better with 21st century skills mirrors Qing et al. (2013) when they wrote that mathematics skills are important skills for students to develop in order to succeed in today's world.

Future Research Recommendations

It is of utmost importance for gamification or gaming activities to be aligned with curriculum objectives. Schifter (2013) confirmed when curriculum objectives and game objectives are properly aligned, then disconnections are eliminated from the curriculum objective and the game design. Proper alignment of curriculum objectives and game objectives have the potential to impact positively students' learning outcomes. This can be attributed to there being a correlation between the learning outcomes and the desired learning outcomes of students.

Notwithstanding the positive results highlighted in this research, more research needs to be done on gamification and its impact on other aspects of learning. The findings of this research are limited to the geographic area within which the study took place. Therefore, the researcher recommends that further longitudinal study be carried with various subjects and grade levels and the findings compared. A longitudinal study may provide a more extensive and authentic reflection of gamification on students' learning outcomes. Finally, it may become necessary to reexamine this study in the future and compare the findings as a result of the developing nature of technological games and gamification being relatively new in education.

Summary

The aim of this study was to gain insight on teachers' perception of gamification on students' academic performance in mathematics. The research bears similar findings to that presented in the review of literature. It symbolizes a positive approach that is geared toward all the necessary stakeholders responsible in educating our nation's children. These include students, parents, teachers, principals, and district officials to

apply the use of gamification and other effective strategies in the teaching of mathematical concepts.

All of the participants agreed with Dicheva et al. (2015) that traditional approaches to instructions are unproductive and tedious to today's learners. The findings of this research indicate that the gamification is an effective pedagogical and assessment tool that can be used in the teaching and learning of mathematical concepts. Gamification has the ability to engage students as well as to teach new concepts and reinforce previously taught concepts. It provides educators with a better opportunity to personalize the learning experience for each student. One of the major benefits of gamification in the learning process, is that students are able to visualize that they are making progress with the concept being taught. This motivates students to strive to attain mastery of concepts. Kapp (2013) confirmed that gamification is a valuable tool for providing personalizing instruction. This will aid students to become more knowledgeable of their progress in the instructional process. The findings of this research reveal that gamification is an effective pedagogical tool for providing differentiated instructions to students. It also allows students to monitor their progress on assigned tasks, which is a motivating factor to them.

The use of the gamification in instruction as well as the development of basic numeracy skills can enhance students' attitude toward problem-solving skills and thus improving their overall performance in the area of mathematics. It cannot be overemphasized that gamification reflects a constructivist approach to learning, as it is more student centered. It creates an opportunity to personalize learning where differentiated instruction can be done much easier. The use of gamification allows

students to be more motivated where they yearn to learn more and become responsible for their own learning.

Finally, the findings suggest that the use of gamification does improve some students' understanding of mathematical concepts. However, there can be pitfalls to the use of gamification if not used properly. Therefore, practitioners are encouraged to implement properly and use this method to increase students' understanding of mathematical concepts. In addition, the use of gamification will reduce inattentiveness of students who are kinesthetic learners and get them actively involved in the teaching and learning process through real-word experiences.

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APPENDIX A

Approval of the Dissertation Proposal

Doctoral Student: Nicola Smith

The Dissertation Committee of the above named Doctoral Student has met and reviewed the Dissertation Proposal titled: INTEGRATING GAMIFICATTION INTO MATHEMATICS INSTRUCTION: A QUALITATIVE EXPLORATORY CASE STUDY ON THE PERCEPTIONS OF TEACHERS AT THE FOURTH AND FIFTH GRADE LEVEL.

The committee has determined that the proposed dissertation is likely to:

1. Make a significant contribution to the field of knowledge;
2. Demonstrate the Candidate's ability to perform independent research;
3. Contain material worthy of publication in a form appropriate to the discipline.

We recommend acceptance of this proposal. It contains all appropriate content and forms.

Dissertation Proposal Requires IRB Review: ___Yes ___No
(If the Dissertation Proposal requires IRB review, a signed IRB Approval must be obtained before beginning the study).

Doctoral Committee Members

Dr. Eileen Yantz
Dr. Carole Smith

Doctoral Committee Chair

_____

Date

APPENDIX B

IRB Approval Form

Name of Student: Nicola Smith

Dissertation Title: Gamification and Mathematics

Date of Application: March 12, 2018

Application Type (The IRB Committee makes this determination):

___ Exempt Review

X Expedited Review

___ Full Review

(The Candidate may want to add a note to the application indicating a rationale for selecting an application type along with justification)

Application Status:

X Approved as Submitted

___ Not Approved

___ Approved with Amendment

The candidate-researcher understands and agrees to maintain the confidentiality of any entity agreeing to assist with providing data, to obtain informed consent from any human participants in the study, and to retain and safeguard written consents and the data for a period of five years from all entities, presenting copies to William Howard Taft University, the participants, and authoritative bodies when appropriate.

Approval

Robert Strouse Taft Law School Dean
IRB Representative Name and Title

Signature

4/24/18
Date

APPENDIX C

Informed Consent

CONSENT FORM
INTEGRATING GAMIFICATTION INTO MATHEMATICS INSTRUCTION: A QUALITATIVE EXPLORATORY CASE STUDY ON THE PERCEPTIONS OF TEACHERS AT THE FOURTH AND FIFTH GRADE LEVEL.

Nicola Smith
William Howard Taft University
School of Education

Read this consent form carefully and ask as many questions as you like before you decide whether you want to participate in this research study. You are free to ask questions at any time before, during, or after your participation in this research.

You are invited to participate in a research study designed to investigate the perceptions of teachers on the impact of gamification on students standardized test scores at the fourth and fifth grade level.

Nicola Smith a doctoral student at William Howard Taft University is conducting this study. You were selected as a possible participant because you are a core content teacher having taught grades 4-5, and have used gamification in your mathematics instruction. Please read this form and ask any questions you may have before agreeing to participate.

Background Information

This investigation seeks to understand the effects of gamification as an active engagement tool on students' academic performance on mathematics standardized exams. The central question guiding this research is how do grades 4-5 teachers perceive the impact of gamification on mathematics standardized examination?

Procedures: If you agree to be in this study, you would be required to:

1. Complete an online questionnaire to verify your eligibility to participate in the study. **Link**: https://www.surveymonkey.com/r/RYLTSJ9
2. Provide a pseudonym to replace your personal name. Only anonymous demographics would be used in this study.
3. Participate in an individual interview where the audio will be recorded. Participants will be asked to review the transcribed transcript for accuracy and suggest comment on revisions. Interviews will take no longer than one hour.
4. Review a preliminary analysis electronically through the use of Google Docs to reflect on accuracy and to provide comments.

Confidentiality

The records of this study would be considered private information in any sort of report I might publish. Research records will be stored securely, and only the researcher will have access to the records. I may share the data I collect from you for use in future research studies or with other researchers; if I share the data that I collect about you, I will remove any information that could identify you, if applicable, before I share the data.

- I will conduct the interviews in a location where others will not easily overhear the conversation.
- The site and participant names will be replaced with pseudonyms to ensure confidentiality.
- All data will be backed up on a password protected flash drive and written accounts with field notes will be stored in a locked cabinet. Note: Per federal regulations, data must be retained for three years upon completion of the study.
- Audio recordings will be stored on the audio recording device stowed in a locked filing cabinet. Only the researcher will have access to the recording device.
- After the federal regulations of the three-year period has passed all materials will be shredded, flash drive, and audio recorder will be physically destroyed.

Voluntary Nature of this Study

Your decision whether to participate would not affect your current or future relationship with the candidate-researcher or William Howard Taft University. If you decide to participate, you are free to withdraw at any time without prejudice. If you choose to withdraw from the study, please contact the researcher at the email address/phone number included below. Should you choose to withdraw, data collected from you will be destroyed immediately and will not be included in this study. You will also be provided with a copy of the concluded dissertation so that you have an opportunity to examine the manner in which the data are being applied.

Benefits of Participating in this Study

The possible benefits of participating in this study are that the findings of the study could provide schools and teachers valuable discoveries regarding best practices and procedures for implementing and integrating gamification in classrooms. This will help other educators in areas such as: planning, adoption, technical support, teaching, and professional development. In addition, educators will be able to learn from others in the field to make decisions based upon past research to develop best practices.

Risks of Participating in this Study

There is minimal risk to participating in this study, meaning that the risks of harm anticipated in the proposed research are not greater than those ordinarily encountered in daily life. If you experience some emotional discomfort after your participation, you are invited to contact the student-researcher at the telephone number or e-mail address listed in the following section to discuss your reactions.

Contacts and Questions

You may ask any questions you have by contacting the researcher by telephone at 336-500-3575 or by e-mail at nickispice84@yahoo.co.uk.

Statement of Consent

I have read the information herein, I have asked questions and received answers, and I have received a copy of this form. I consent to participate in this study.

_____ _____

Participant/Subject Date

Candidate/Researcher Statement

All information contained herein is accurate. I have provided the participant with a copy of this form.

_____

Candidate/Researcher Date

APPENDIX D

Criterion Questionnaire

The purpose of this qualitative exploratory case study is to examine the perceptions of public school teachers on the effects of gamification as an active engagement tool on students' academic performance on mathematics standardized exams.

Thank you for consenting to be a possible participant in the study. I would ask that you complete the following questionnaire as soon as possible to verify your eligibility to be part of this study. Thank you for completing this questionnaire in a timely manner.

Question one: First Name and Last Name
Question two: What grade do you teach?
Question three: How many years have you worked at this school district?
Question four: How many total years have you been teaching?
Question five: Have you used gamification tools with your students?
Questions six: Have you been using gamification tools in your mathematics instruction for at least one term (45 days) or longer?
Questions seven: Did you use gamification tools the previous academic year 2016-2017?
Question eight: How many academic school years have you been using gamification tools in your mathematics instruction?

APPENDIX E

Individual Open-Ended Interview Questions

1. Please describe your experience of using gamification in mathematics instruction?
2. What factors have impacted your use in integrating gamification in mathematics instruction in the classroom?
3. Please describe your first impression about gamification when it was first introduced to you.
4. Please describe how you felt about gamification after integrating into your mathematics instruction for the first time.
5. How long have you been using gamification in your mathematics instruction?
    a. How do you feel now about gamification after using it over time?
    b. What attitudes or personal perceptions have changed since you have used it over time?
6. What types of gamification tools do you use with your students?
7. How has gamification impacted your teaching?
8. How did you change your delivery of the content when integrating gamification?
9. How did you change your student assessment of the content when integrating gamification in mathematics instruction Education?
10. Please describe how you engage students with gamification in your mathematics instruction.
11. Have you found any changes in student learning using gamification?
12. Please describe how gamification works with your subject frameworks and Common Core standards.
13. How do you perceive the use of gamification in your mathematics instruction?
14. Please describe how students used the gamification in your mathematics instruction.

15. Please describe how students perceive the use of gamification in your mathematics instruction.
16. Please describe any professional development you have received using gamification.
17. How do you perceive professional development and support for using gamification in the classroom?
18. What technical issues have you encountered when using gamification?
19. What would you suggest to school systems looking to implement gamification in mathematics instructions?
20. What suggestions do you have for a colleague interested in integrating gamification in mathematics instruction?

APPENDIX F

Approval of the Dissertation

Doctoral Student: Nicola Smith

The Dissertation Committee of the above named Doctoral Student has reviewed the documentation and discussed the outcome of the oral defense of the Dissertation entitled: The committee has determined that the dissertation: Integrating Gamification into Mathematics Instruction: A Qualitative Exploratory Case Study on the Perceptions of Teachers at the Fourth and Fifth Grade Level.

1. Makes a significant contribution to the field of knowledge;
2. Demonstrates the Candidate's ability to perform independent research;
3. Contains material worthy of publication in a form appropriate to the discipline.

Dissertation Committee Members

Dr. Eileen Yantz
Dr. Carole Smith

Doctoral Committee Chair

_____ _____