INVESTIGATING THE INFLUENCE OF GAMIFICATION ON STUDENTS ENGAGEMENT IN LEARNING MATHEMATICS

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A PROJECT WORK SUBMITTED TO THE DEPARTMENT OF CURRICULUM AND INSTRUCTIONAL TECHNOLOGY, FACULTY OF EDUCATION, UNIVERSITY OF BENIN, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF SCIENCE EDUCATION DEGREE B.Sc.(Ed) IN MATHEMATICS EDUCATION.

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CERTIFICATION

We, the undersigned, certify that this project work is adequate in scope and was carried out by Onyebuchi Chidubem ONYEONU, in the department of Curriculum and Instructional Technology, Faculty of Education, University of Benin, Benin City, Edo State, Nigeria.

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DEDICATION

This project is dedicated to God almighty.

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ABSTRACT

This study investigated the influence of gamification on student's engagement in learning Mathematics through the Research Questions such as How does the use of gamification strategies influence students' levels of engagement in learning mathematics compared to traditional teaching methods? What specific game elements are most effective in enhancing students' motivation and participation in mathematics? What are the factors influencing effectiveness of gamification in mathematics? To what extent does gamification impact the cognitive, emotional, and behavioral dimensions of student engagement in mathematics? What are the challenges affecting the implementation of gamification in mathematics education?

The research design employed was the descriptive survey research design. The Simple random technique was used to select students using gamification in learning mathematics. The instrument that was used for the data collection was a structured questionnaire. The instrument was administered by the researcher. The data was analyzed using descriptive statistics showing mean and standard deviation

On the basis of the findings made in the study, we conclude that most of the responses on how does the use of gamification strategies have influence on students' levels of engagement in learning mathematics compared to traditional teaching methods, Most of the responses on specific game elements have effects in enhancing students' motivation and participation in mathematics, most of the responses on the factors influencing effectiveness of gamification in Mathematics have impact on students engagement in learning Mathematics, Most of the responses on extent of gamification impact the cognitive, emotional, and behavioral dimensions of student engagement in Mathematics and there are challenges affecting the implementation of gamification in Mathematics education.

The implications of this study highlight the need for continuous professional development programs, adequate provision of gamification resources, and supportive school policies to encourage the integration of gamified strategies in mathematics education. Conclusively, the results emphasize that teachers who lack sufficient training or access to necessary resources face challenges in effectively implementing gamification in their lessons. The researcher recommends that workshops and capacity-building programs be organized to enhance teachers' understanding of gamification techniques, improve their ability to design engaging learning experiences, and ultimately enhance students' participation and performance in mathematics.

CHAPTER ONE

INTRODUCTION

Background of the Study

Mathematics is a difficult lesson that needs a lot of effort to be taught successfully. For many years, both teachers and learners believe that only certain people are so lucky with mathematical abilities or called "math people" while the rest of them still should struggle to understand this learning subject (Anderson, Boaler, & Dieckmann, 2018). Improving the students' learning outcomes in STEM (science, technology, engineering, and mathematics) could be done by utilizing digital games. It can increase the student's interest in learning and turn bearable activities to be more fun. Not only that, designing gamified activities has been favored by modern theories and practices to satisfy and increase the learners' efficacy. Gaming experience in learning enables learners to obtain relevant skills and practical knowledge in the 21st century.

The previous studies of gamification in educational contexts show mixed results ranging from negative, neutral, and positive. Some of them maintain that the student's motivation, cognition, and spirit of learning would increase through gamification.

Gamification is grounded in the principles of motivation and engagement, aiming to create immersive and enjoyable experiences for learners. It incorporates elements such as point systems, badges, leaderboards, levels, and challenges, all designed to foster a sense of achievement, competition, and progression. In education, these features are used to

align students' intrinsic and extrinsic motivations with learning objectives (Madueke, 2018). Theoretical frameworks such as self-determination theory highlight the role of intrinsic motivation in fostering engagement, suggesting that gamification can satisfy psychological needs for competence, autonomy, and relatedness. By creating a sense of accomplishment and promoting collaboration, gamification has the potential to address the emotional, behavioral, and cognitive dimensions of student engagement.

Student engagement, a key variable in this study, is a multifaceted construct encompassing emotional, behavioral, and cognitive components. Emotional engagement relates to students' interest and attitudes toward mathematics, which can significantly influence their willingness to participate in learning activities. Behavioral engagement involves active participation, persistence, and effort in tasks, which are critical for mastering mathematical skills (Adewole, 2019). Cognitive engagement refers to the depth of processing and investment in learning, reflecting students' ability to think critically and solve problems. These dimensions are interconnected, and a decline in one area can adversely affect overall engagement.

Mathematics learning poses unique challenges, as it often requires abstract thinking, problem-solving, and logical reasoning. Students may find these aspects intimidating, leading to disengagement and the development of negative attitudes toward the subject. Gamification can potentially transform these challenges into opportunities by providing a supportive and stimulating learning environment. For example, interactive math games can make abstract concepts more tangible, while immediate feedback mechanisms

inherent in gamified systems can help students identify and correct errors, reinforcing their understanding and building confidence (Samuel, 2019).

The integration of gamification in mathematics education is further supported by evidence suggesting that game-like features enhance learning outcomes by promoting sustained attention, intrinsic motivation, and active participation. Research has demonstrated that gamification can lead to improved academic performance, increased time spent on learning activities, and greater enjoyment of the learning process. Despite these promising findings, the long-term impact of gamification on engagement and learning outcomes, particularly in mathematics, remains an area that requires further exploration. Individual differences, such as age, gender, and technological proficiency, may influence the effectiveness of gamification strategies, highlighting the need for tailored approaches.

Statement of Problem

The study on the influence of gamification on students' engagement in learning mathematics addresses several interconnected challenges. Mathematics, a subject critical to academic and professional development, often elicits low levels of engagement among students. This disengagement is partly due to the abstract and demanding nature of mathematical concepts, which many students find intimidating or uninteresting. As a result, a significant number of learners demonstrate reduced participation, lack of motivation, and minimal effort in mathematics tasks, leading to poor performance and negative perceptions of the subject.

Math anxiety further compounds the problem, creating a psychological barrier that prevents students from fully engaging with the learning process. This anxiety, which stems from fear of failure or difficulty in understanding, undermines students' confidence and willingness to persist in solving mathematical problems. Additionally, traditional teaching methods frequently fail to inspire curiosity or sustain interest, contributing to a lack of intrinsic motivation among students to engage meaningfully with mathematics.

While gamification offers a promising solution to enhance engagement, its implementation presents several challenges. One significant concern is the variability in its effectiveness across different contexts and student populations. Gamification strategies may not address the diverse needs of learners, as factors such as age, learning preferences, and technological proficiency influence how students respond to gamified activities. Moreover, there is a risk that gamification could lead to an overemphasis on extrinsic rewards, such as points and badges, rather than fostering a deep and genuine interest in learning mathematics. This reliance on rewards may result in superficial engagement, with motivation waning when these incentives are removed.

Technological barriers also pose a significant challenge. Successful gamification often relies on access to digital tools and platforms, which may not be available in all schools or to all students. Limited access to devices, internet connectivity, or adequate resources can hinder the adoption and effectiveness of gamified learning environments. Furthermore, effective implementation requires educators to be well-prepared and trained

in designing and utilizing gamified strategies. A lack of teacher expertise or confidence in this area can compromise the quality and impact of gamified interventions.

Measuring the success of gamification in enhancing engagement is another critical issue. Student engagement, particularly in its emotional and cognitive dimensions, is challenging to assess reliably. Developing and applying valid tools to evaluate the impact of gamification on these aspects of engagement is essential to understanding its efficacy. Additionally, ensuring the sustainability and scalability of gamification requires ongoing efforts to update and maintain gamified platforms, which can be resource-intensive.

Research Questions

The following research questions were raised to guide the study:

1. How does the use of gamification strategies influence students' levels of engagement in learning mathematics compared to traditional teaching methods?
2. What specific game elements are most effective in enhancing students' motivation and participation in mathematics?
3. What are the factors influencing effectiveness of gamification in mathematics?
4. To what extent does gamification impact the cognitive, emotional, and behavioral dimensions of student engagement in mathematics?
5. What are the challenges affecting the implementation of gamification in mathematics education?

Purpose of the Study

The major purpose of this study is to Investigate the Influence of Gamification on students engagement in learning mathematics

1. To examine the influence of gamification strategies on students' levels of engagement in learning mathematics compared to traditional teaching methods.
2. To identify the specific game elements that are most effective in enhancing students' motivation and participation in mathematics.
3. To identify the factors influencing the effectiveness of gamification in mathematics
4. To analyze the impact of gamification on the cognitive, emotional, and behavioral dimensions of student engagement in mathematics.
5. To identify the challenges that affect the implementation of gamification in mathematics education,

Significance of the Study

The significance of this study lies in its potential to address the persistent challenges associated with engaging students in learning mathematics. Mathematics, a subject that forms the foundation for many academic and professional fields, is often regarded as difficult and intimidating by students. By exploring the influence of gamification on student engagement, this study aims to offer innovative strategies to make learning

mathematics more interactive, enjoyable, and effective. The findings have the potential to improve students' attitudes toward mathematics, reduce math anxiety, and foster a deeper understanding of mathematical concepts, ultimately enhancing their academic performance and long-term success.

For teachers and educators, the study provides valuable insights into how gamification can be used as a pedagogical tool to increase student participation and motivation. With concrete evidence and practical recommendations, educators will be better equipped to implement gamified approaches in their classrooms, catering to the diverse needs and learning styles of their students. This, in turn, supports the broader goal of creating inclusive and engaging learning environments.

School administrators and policymakers also stand to benefit from the study's findings, as they provide a basis for making informed decisions about investing in gamification tools and integrating them into educational systems. The study can guide resource allocation and professional development programs, ensuring that schools are equipped to harness the potential of gamification effectively.

Curriculum designers can use the study to incorporate gamification principles into mathematics curricula, making the subject more appealing and accessible to students. By aligning gamified elements with learning objectives, curriculum developers can create materials that not only capture students' interest but also promote meaningful learning outcomes.

Parents and guardians are indirect beneficiaries of this research, as it provides them with an understanding of how gamification can positively impact their children's engagement and achievement in mathematics. Equipped with this knowledge, parents can better support their children's educational journey and foster a positive attitude toward learning.

Educational technology developers also gain from this study by receiving feedback on the effectiveness of their gamified platforms and tools. The findings can guide the refinement of their products, ensuring they meet the needs of students, teachers, and schools effectively.

This research contributes to the academic and practical knowledge base in the field of education. Future researchers can build upon the findings to explore related areas, such as the long-term impact of gamification on learning outcomes, its application in other subjects, and strategies for overcoming implementation challenges.

Scope and Delimitation of the Study

The scope of the research is focused on the geographical area of Egor Local Government of Benin City, Edo State, This study will take place in Egor Local Government Area, Edo State, Nigeria, characterized by a mix of urban and semi-urban communities.

Definition of Terms

Influence: refers to the power or capacity to have an effect on the behavior, development, opinions, or actions of someone or something.

Gamification: refers to the application of game design elements and principles in non-game contexts to enhance engagement, motivation, and participation.

Engagement: refers to the level of involvement, interest, and emotional commitment that an individual has towards a particular activity, task, or subject.

Mathematics: is the field of study that deals with numbers, quantities, shapes, structures, and patterns, as well as the relationships and operations between them.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

This chapter reviews the related literature on the influence of gamification on students engagement in learning mathematics. The review focus on the following sub-headings:

- The Concept of Gamification
- Gamification in Mathematics Education and Students Engagements
- The Impact of Gamification on Student Engagement Mathematics
- Factors Affecting the Effectiveness of Gamification in Mathematics
- Gamification Strategies and Students' Levels of Engagement in Learning Mathematics.
- Gamification Impact the Cognitive, Emotional, and Behavioral Dimensions of Student Engagement in Mathematics
- Game Elements and Students' Motivation and Participation in Mathematics
- Challenges affecting the implementation of gamification in Mathematics Education
- Summary of Reviewed Literature

The Concept of Gamification

Gamification refers to the application of game design elements and principles in non-game contexts to motivate and enhance user engagement, learning, and productivity. It involves incorporating elements such as points, badges, levels, leaderboards, and challenges—features commonly found in video games into everyday activities or learning environments. The goal of gamification is to tap into the intrinsic motivation that games often evoke, such as a sense of accomplishment, competition, and mastery, to improve outcomes in areas such as education, business, and health (Deterding et al., 2019). The concept of gamification gained significant attention in the early 21st century, particularly in educational settings. It emerged from the idea that games are intrinsically engaging and that these engaging elements can be transferred to other environments to foster motivation and participation. One of the key theories supporting gamification is Self-Determination Theory (SDT), which emphasizes the importance of autonomy, competence, and relatedness in fostering motivation (Deci & Ryan, 2018). Gamification can support these three psychological needs by allowing students to set their own learning pace (autonomy), offering rewards for achievements (competence), and encouraging social interaction through collaborative games or leaderboards (relatedness).

In the educational context, gamification aims to transform the traditional, often passive, learning experience into an interactive and participatory one. In classrooms, teachers can integrate game mechanics to make the learning process more enjoyable and motivating. For example, a teacher might use a point system where students earn points for

completing assignments, participate in challenges to level up, or compete with their peers on a leaderboard. These elements encourage active participation and create an environment where students feel more motivated to engage with the material (Anderson & Whitburn, 2019).

Gamification also differs from serious games, which are games specifically designed with educational objectives in mind. While serious games create an immersive game-like environment, gamification applies game principles to non-game contexts. Thus, gamification does not necessarily involve the development of entire game structures; rather, it incorporates game mechanics to enhance the experience of tasks or learning (Werbach & Hunter, 2012). The use of gamification is seen as a way to provide external motivation through rewards, recognition, and competition, while still focusing on the intrinsic value of the task itself.

Research on the effectiveness of gamification in education has shown mixed results. Some studies have highlighted its positive impact on student engagement and motivation, noting that students who are actively involved in gamified activities tend to show higher levels of participation and persistence (Hamari et al., 2014). Gamification can also promote a sense of achievement and progress, which are powerful motivators for learners, especially in challenging subjects like mathematics. However, critics argue that over-reliance on extrinsic rewards such as points or badges might reduce students' intrinsic motivation over time, leading to dependency on rewards rather than genuine interest in the subject (Deci et al., 1999).

In the context of mathematics education, gamification has been particularly useful in addressing the issue of math anxiety and disengagement. Many students find mathematics intimidating, and traditional teaching methods can often lead to passive learning and low participation. Gamified approaches, on the other hand, have been shown to make mathematics more accessible, encouraging students to approach problems with a mindset of exploration and challenge rather than fear (Tze & Lee, 2014). By turning mathematical tasks into games with clear goals, feedback, and rewards, students are more likely to become actively involved and motivated to tackle complex problems. Despite the potential benefits, there are several challenges associated with the implementation of gamification. The design of effective gamified systems requires careful consideration of students' needs, the nature of the subject matter, and the available technological resources. For example, ensuring that the rewards provided by gamification are meaningful and aligned with learning objectives is essential. If rewards are perceived as arbitrary or disconnected from the content, they may undermine the educational goals of the gamified experience (Kapp, 2012). Moreover, the varying levels of technological access and teacher preparedness can impact the success of gamified initiatives, especially in schools with limited resources.

Gamification in Mathematics Education and Students Engagement

Gamification in mathematics education is the integration of game design elements and principles into the teaching and learning process of mathematics. This approach aims to enhance students' engagement, motivation, and achievement in a subject that many find

challenging and intimidating. By using elements typically found in games, such as points, badges, levels, challenges, and leaderboards, educators seek to create a more dynamic and enjoyable learning experience, encouraging students to actively participate, persist through difficulties, and develop a deeper understanding of mathematical concepts. Mathematics, often seen as a rigid and complex subject, can create barriers to engagement for students, such as fear of failure, lack of confidence, or math anxiety. These challenges can significantly hinder students' motivation to actively engage with the content and lead to poor performance (Tze & Lee, 2014). Gamification, by contrast, provides a structure that promotes positive reinforcement and a sense of accomplishment. For instance, the use of rewards such as points or badges for completing tasks and challenges allows students to see their progress and feel motivated to continue learning (Anderson & Whitburn, 2015). These rewards not only enhance emotional engagement but also help students build a sense of competence, one of the key factors in fostering intrinsic motivation, according to Self-Determination Theory (Deci & Ryan, 2018).

One of the primary goals of gamification in mathematics education is to address the issue of disengagement. By transforming learning into an interactive and game-like experience, gamification encourages active participation and persistence in solving problems (Gee, 2017). For example, students might earn points or level up as they solve mathematical problems correctly or complete challenges within a certain time frame. This not only reinforces the content being learned but also instills a sense of achievement, which is essential for maintaining motivation in a subject like mathematics, where students often

struggle with complex concepts (Kapp, 2017). In the context of mathematics, gamification can also help make abstract concepts more tangible and easier to grasp. Interactive math games, for example, can be used to simulate real-life mathematical situations, enabling students to apply mathematical knowledge in a hands-on, experiential way. These interactive activities offer immediate feedback, which is crucial in mathematics learning, as it helps students identify errors, correct misconceptions, and deepen their understanding of the material (Hamari et al., 2016). Moreover, game-based approaches allow for a level of personalization that traditional methods often lack, offering students the ability to progress at their own pace and revisit challenging topics as needed. Research has shown that gamification can lead to improvements in student motivation and performance in mathematics. Studies have found that students who engage in gamified math lessons exhibit higher levels of participation, persistence, and enthusiasm compared to those who experience traditional instruction. For example, a study by Muldner et al. (2014) demonstrated that students who participated in a gamified learning environment showed greater engagement and improved problem-solving skills. The game elements provided a compelling reason for students to engage with the material, as they could earn rewards and progress through levels as they completed tasks, which reinforced a positive learning cycle.

Despite the promising potential of gamification, there are challenges to its implementation in mathematics education. One significant issue is ensuring that the gamified elements are effectively aligned with the educational objectives of the

mathematics curriculum. If the rewards and game mechanics are not directly related to the learning outcomes, they may distract students from the core content or lead to superficial learning (Kapp, 2017). Moreover, the effectiveness of gamification can vary depending on the context and the individual needs of the students. While some students may thrive in gamified environments, others may struggle with the competitive elements or feel disengaged if they do not see the value in the rewards system (Bunchball, 2018).

Technological limitations can also pose a barrier to the widespread adoption of gamification in mathematics education. While many gamified learning platforms are available, they often require significant technological infrastructure, which may not be accessible to all schools, particularly those in under-resourced areas. Teachers may also face challenges in designing and implementing gamified lessons, as it requires not only technical expertise but also creativity and careful planning to ensure that the games and activities are pedagogically sound (Deterding et al., 2019). Training and professional development for educators are crucial to ensure the effective integration of gamification into the classroom. Mathematics education plays a central role in preparing students for future academic and professional success. However, it is often perceived as a challenging and abstract subject, which can lead to disengagement, low motivation, and a lack of interest in learning mathematical concepts. Research has shown that the effectiveness of mathematics education is significantly influenced by the level of student engagement, which is critical for fostering deep learning, persistence, and academic achievement in mathematics (Fredricks, Blumenfeld, & Paris, 2017). Engagement in the context of

education generally refers to the emotional, behavioral, and cognitive involvement of students in their learning process. In mathematics education, student engagement is particularly important, as it determines the extent to which students are willing to actively participate in learning tasks, persist through difficulties, and achieve mastery in mathematical concepts (Skinner & Belmont, 2018).

One of the most significant challenges in mathematics education is overcoming mathematics anxiety, a condition that affects many students and leads to avoidance behaviors, such as reluctance to attempt problems, difficulty concentrating, and a lack of confidence in solving mathematical tasks (Tze & Lee, 2017). Mathematics anxiety is often a barrier to engagement, leading students to feel disconnected from the content. According to Self-Determination Theory (Deci & Ryan, 1985), fostering intrinsic motivation through engagement can help mitigate such anxiety by making the learning process more enjoyable and less intimidating. When students feel more confident in their abilities and motivated to engage with the material, they are more likely to invest the effort needed to understand and master mathematical concepts.

Emotional engagement is an important dimension of student engagement in mathematics. It involves students' emotional reactions and attitudes towards learning, which can significantly affect their motivation to participate in lessons. Positive emotions, such as interest, excitement, and pride in solving mathematical problems, enhance students' commitment to the subject. On the other hand, negative emotions, such as frustration, boredom, or anxiety, can hinder engagement and contribute to feelings of incompetence,

which undermine motivation (Skinner & Belmont, 2017). Creating an emotionally supportive classroom environment, where students feel safe to make mistakes and are encouraged to take risks, is crucial for fostering emotional engagement. In mathematics, where failure is often viewed as an indicator of inability, it is essential to provide opportunities for students to experience success in manageable increments, which can promote positive emotions and enhance engagement (Anderson & Whitburn, 2016).

Behavioral engagement refers to the extent to which students actively participate in class activities, persist in problem-solving, and apply effort to completing tasks. In mathematics education, this type of engagement is particularly important as it directly impacts the amount of time and effort students devote to practicing mathematical skills, which is essential for mastery. Engaged students are more likely to put in the effort to tackle complex mathematical problems, participate in group discussions, and apply problem-solving strategies. Research suggests that students who are behaviorally engaged in mathematics education are more likely to experience higher academic performance and to develop a positive attitude toward the subject (Fredricks et al., 2017). This underscores the importance of designing learning activities that actively engage students in the process, allowing them to participate in both individual and collaborative tasks that promote skill development and critical thinking (Hamari, Koivisto, & Sarsa, 2017).

Cognitive engagement refers to the mental effort students put into learning and understanding mathematical concepts. In mathematics education, cognitive engagement is associated with students' willingness to exert effort in mastering challenging concepts,

thinking critically, and applying knowledge in novel contexts. Cognitive engagement goes beyond surface-level learning, such as memorizing formulas, and encourages deeper processing, such as analyzing mathematical problems, identifying patterns, and making connections between different mathematical ideas (Fredricks et al., 2015). Strategies that promote cognitive engagement in mathematics education include providing opportunities for inquiry-based learning, where students actively explore mathematical concepts and solve complex problems, as well as the use of technology and interactive tools that challenge students to think critically about the material (Gee, 2016). The link between engagement and achievement in mathematics is well-documented. Studies have shown that students who are more engaged in their learning tend to perform better academically. For example, research by Fredricks et al. (2004) found that students who exhibit high levels of engagement are more likely to achieve high levels of success in mathematics, as they invest more effort in learning and demonstrate persistence in the face of difficulties. Engaged students are also more likely to develop a positive attitude towards mathematics, which contributes to a cycle of continued engagement and academic success (Hamari et al., 2016). In contrast, students who are disengaged in mathematics often perform poorly, and their lack of motivation can lead to long-term disengagement and academic underachievement.

Mathematics educators play a critical role in fostering student engagement by adopting strategies that address the various dimensions of engagement. For instance, teachers can design instruction that is interactive, challenging, and connected to real-world

applications to enhance cognitive engagement. Additionally, teachers can promote emotional engagement by creating a classroom atmosphere that is supportive and non-threatening, encouraging students to view challenges as opportunities for growth rather than as signs of failure (Kapp, 2018). Moreover, offering students choices and fostering autonomy in the learning process can increase both emotional and behavioral engagement, as students feel more in control of their learning.

Incorporating gamification in mathematics education is one promising approach to improving student engagement. Gamification, the use of game elements in non-game contexts, has been found to increase student motivation, participation, and achievement in mathematics. By adding game-like elements such as points, rewards, and levels to mathematics tasks, students are more likely to feel motivated and engaged. These elements can make learning more enjoyable and encourage students to persevere in the face of challenging mathematical problems (Deterding et al., 2017).

The Impact of Gamification on Student Engagement

Gamification, the use of game-like elements and mechanics in non-game contexts, has gained considerable attention in recent years as a strategy to enhance student engagement in educational settings. The concept of gamification in education is centered around incorporating features such as points, badges, levels, and leaderboards into learning activities to create an environment that motivates and engages students. In the context of student engagement, gamification has shown to have significant effects on emotional,

behavioral, and cognitive involvement in learning processes (Deterding et al., 2017). Engagement is a critical determinant of students' success in academic settings, as it influences how actively they participate in lessons, how much effort they put into their work, and how deeply they understand the content (Fredricks, 2016). As such, gamification offers a promising approach to increasing engagement in subjects that students may otherwise find tedious or challenging, such as mathematics.

One of the primary ways gamification influences student engagement is through its ability to enhance emotional engagement. Emotional engagement refers to the emotional responses and attitudes students have toward learning, such as excitement, pride, and interest. Research has shown that gamification can significantly improve emotional engagement by making learning activities more enjoyable and rewarding (Anderson & Whitburn, 2015). Game-like features, such as rewards, challenges, and narratives, evoke positive emotional reactions that can help students feel more connected to the material. For example, earning points or unlocking new levels in a gamified lesson can create a sense of accomplishment and boost students' self-esteem, motivating them to persist in their learning (Hamari, Koivisto, & Sarsa, 2018). When students experience positive emotions linked to learning, they are more likely to continue engaging with the subject matter and develop a deeper interest in the content (Gee, 2017).

Gamification has a profound impact on behavioral engagement, which refers to the actions students take during the learning process, such as participating in class activities, completing assignments, and interacting with their peers. Gamified elements like points,

badges, and competition can create a sense of urgency and increase participation, as students are more likely to stay focused on the tasks in order to earn rewards and achieve goals (Kapp, 2017). For instance, students might be more inclined to solve a challenging math problem if doing so allows them to level up or receive a badge. The competitive aspect of gamification, such as comparing scores on a leaderboard, can also motivate students to outperform their peers, leading to increased engagement in the task at hand (Tze & Lee, 2014). Furthermore, the immediate feedback provided by gamification helps students stay engaged by reinforcing positive behaviors and correcting mistakes in real time, which is crucial for maintaining momentum and progress in their learning journey.

Cognitive engagement, which involves the mental effort students devote to understanding and mastering content, is another aspect of engagement that is enhanced through gamification. Gamification encourages students to engage more deeply with learning material by promoting critical thinking, problem-solving, and active participation. In a gamified classroom, students may be asked to solve complex problems or complete tasks that require higher-order thinking, which pushes them to stretch their cognitive abilities (Hamari et al., 2017). By adding challenges and obstacles that require creative solutions, gamification fosters an environment where students are intellectually engaged and actively involved in making sense of the content. Research has shown that students who are cognitively engaged are more likely to develop a deeper understanding of the material and retain information for the long term (Fredricks et al., 2016). Furthermore, gamified environments allow for personalized learning experiences, where students can work at

their own pace and receive tailored challenges that match their skill levels, further promoting cognitive engagement.

The intrinsic motivation of students, which is essential for sustaining engagement, is also significantly affected by gamification. According to Self-Determination Theory. Intrinsic motivation is driven by the inherent enjoyment or satisfaction that comes from engaging in an activity, rather than from external rewards. Gamification can foster intrinsic motivation by providing students with a sense of autonomy, competence, and relatedness, all of which are key components of motivation according to this theory (Deci & Ryan, 2017). When students have control over their learning paths and can make decisions about how they approach tasks, they feel more autonomous and empowered, leading to greater engagement. Moreover, by allowing students to experience progress through levels, challenges, and achievements, gamification helps build a sense of competence, making students feel capable and confident in their abilities. The social aspect of gamification, such as collaborating with peers or competing in teams, fosters a sense of relatedness, which further enhances engagement by making learning a more interactive and social experience.

The effects of gamification on engagement are not limited to short-term improvements in participation. Studies have shown that gamification can lead to sustained engagement over time, as it helps establish a cycle of motivation and achievement. For example, students who are able to continuously earn rewards, advance through levels, and receive positive feedback are more likely to stay engaged with the material in the long term

(Muldner et al., 2017). The sense of progress and accomplishment provided by gamification can also combat feelings of frustration and burnout, which are common when students struggle with difficult material. By breaking down learning into smaller, manageable tasks and rewarding incremental achievements, gamification encourages students to stay focused and committed, even when faced with challenges (Anderson & Whitburn, 2017). This ability to maintain engagement over time is particularly valuable in subjects like mathematics, where sustained effort is required to master complex concepts.

However, despite the many benefits of gamification, its effectiveness in enhancing student engagement depends on several factors, such as the design of the gamified elements and the context in which they are implemented. If the game mechanics are not well-aligned with the learning objectives or if students do not find the rewards meaningful, gamification may fail to produce the desired results. For instance, overly simplistic or repetitive tasks may not challenge students sufficiently, leading to boredom rather than engagement (Deterding et al., 2016). Additionally, some students may be less motivated by competitive elements or rewards, which underscore the importance of tailoring gamified experiences to the individual needs and preferences of students (Bunchball, 2017).

Factors Affecting the Effectiveness of Gamification in Mathematics

The integration of gamification in mathematics education has proven to be a promising approach for improving student engagement and achievement. However, its effectiveness is influenced by several factors that can enhance or hinder the desired outcomes. The design of the gamified experience, the alignment with educational goals, the individual characteristics of students, and the context in which gamification is implemented all play crucial roles in determining the success of gamification strategies in mathematics education. Understanding these factors is essential for maximizing the benefits of gamification while ensuring that it contributes to meaningful learning experiences. One of the most significant factors influencing the effectiveness of gamification in mathematics is the design of the gamified elements themselves. The way in which game mechanics such as points, badges, leaderboards, levels, and challenges are incorporated into the learning process can either engage students or lead to disengagement. According to Deterding et al. (2017), the game mechanics should be well-aligned with the learning objectives to ensure that students' efforts are directed towards meaningful academic goals. For instance, points and badges should not just be used as superficial rewards; they must reflect the mastery of mathematical concepts and encourage students to deepen their understanding of the subject matter. If the gamification elements are not tied to educational outcomes or are overly focused on extrinsic rewards, they may fail to foster the intrinsic motivation that leads to long-term engagement and achievement.

Another critical factor is the balance between challenge and skill. A key principle in game design is the notion of flow, a state in which students are fully immersed and engaged in an activity. According to Csikszentmihalyi (2016), flow occurs when the challenges of an activity are appropriately balanced with the skill level of the individual. In the context of gamification, if the tasks are too easy, students may become bored and disengaged, while tasks that are too difficult may lead to frustration and a lack of motivation. Therefore, it is important to design mathematical challenges within a gamified system that are appropriately challenging for students, allowing them to experience success while also pushing them to expand their skills. This requires careful consideration of the students' prior knowledge and the difficulty level of the tasks involved in the gamified learning process.

The personalization of the gamified experience is also a critical factor. As students have diverse learning styles, preferences, and abilities, gamification strategies should be flexible enough to cater to these differences. Self-determination theory (Deci & Ryan, 2017) emphasizes the importance of autonomy, competence, and relatedness in fostering motivation and engagement. In gamified mathematics education, students should have some level of autonomy in how they approach tasks, such as the option to choose from a variety of challenges or learning paths. Moreover, the system should allow students to progress at their own pace, ensuring that they feel competent as they encounter and overcome challenges. Personalized feedback, which highlights individual progress and areas for improvement, also enhances students' sense of competence and promotes a

growth mindset (Dweck, 2016). When students are able to tailor their learning experience to their needs, they are more likely to remain engaged and motivated.

The social aspect of gamification can also significantly impact its effectiveness. Collaborative and competitive elements within gamified environments can foster a sense of community, encourage peer interaction, and provide additional motivation through social comparison. Research has shown that peer collaboration can enhance problem-solving abilities and contribute to deeper learning (Johnson & Johnson, 2017). In gamified mathematics education, students may work together in teams to solve problems or compete on leaderboards, providing a social context that promotes engagement. However, it is important to ensure that these social elements do not create unhealthy competition or stress among students. If students feel that they are constantly being compared to their peers or if the competitive aspect overshadows the educational goals, it can lead to negative emotions such as anxiety or feelings of inadequacy.

The context in which gamification is implemented also plays a significant role in its effectiveness. This includes the classroom environment, the teacher's role, and the available technological resources. The teacher's attitude toward gamification and their ability to effectively integrate it into the curriculum can greatly influence how students engage with the gamified content. A teacher who is enthusiastic about gamification and uses it as a tool for enhancing learning will likely motivate students to participate more fully (Hamari, Koivisto, & Sarsa, 2017). On the other hand, if gamification is implemented in a way that feels forced or disconnected from the learning objectives,

students may fail to see its relevance and disengage. Additionally, the availability of technology plays a key role in the success of gamification. Digital platforms that support gamified learning, such as educational apps and online tools, can facilitate the implementation of game mechanics and provide students with immediate feedback, which enhances engagement. However, reliance on technology also requires access to appropriate devices and infrastructure, which may not always be available, particularly in underfunded educational settings

The motivation of the students themselves is another important factor affecting the success of gamification in mathematics education. Students who are already intrinsically motivated and interested in the subject may respond more positively to gamification, as it adds an element of fun and novelty to their learning experience. However, students who are disengaged or lack confidence in their mathematical abilities may not find gamification as effective, especially if the challenges feel overwhelming or if the rewards do not resonate with their personal interests (Deterding et al., 2017). For these students, gamification may need to be carefully designed to build confidence and provide sufficient support, such as scaffolding or guidance to ensure that they do not become discouraged.

The cultural and institutional context in which gamification is applied should be considered. Different cultural attitudes towards education, competition, and gaming may affect how gamified strategies are received by students and educators. In some cultures, competition and extrinsic rewards may be highly motivating, while in others,

collaboration and intrinsic motivation may be emphasized more (Hamari et al., 2017). Moreover, the institutional policies regarding assessment and grading can influence how gamification is implemented. If gamified activities are not aligned with formal assessment criteria, students may perceive them as less valuable, undermining their motivation to engage fully.

Gamification Strategies and Students' Levels of Engagement in Learning Mathematics

The introduction of gamification strategies into mathematics education represents a significant departure from traditional teaching methods. While traditional approaches often rely on lectures, repetitive exercises, and summative assessments, gamification incorporates game-like elements such as challenges, rewards, and interactivity to create an engaging and motivating learning environment. This shift has sparked considerable interest among educators and researchers due to its potential to enhance student engagement, an essential factor in academic success.

Gamification influences students' emotional engagement in mathematics by fostering positive attitudes and reducing anxiety associated with the subject. Mathematics is often perceived as a challenging and abstract discipline, leading to disengagement and math anxiety among students (Ashcraft & Krause, 2017). Gamified learning environments, however, introduce elements such as points, badges, and interactive problem-solving activities, which make the learning experience more enjoyable and less intimidating. For

example, when students earn rewards for completing tasks or solving complex problems, they experience a sense of accomplishment that builds confidence and reduces negative emotions associated with failure (Deci & Ryan, 2016). This emotional shift is particularly important because students who feel positively about their learning experiences are more likely to persevere through challenges and develop an intrinsic interest in mathematics.

In terms of behavioral engagement, gamification strategies encourage active participation and sustained effort in ways that traditional methods may not. Traditional teaching methods often focus on passive learning, with students listening to lectures or following rigid procedures to complete exercises. In contrast, gamification transforms mathematics lessons into interactive and dynamic activities. Features such as time-based challenges, collaborative team exercises, and progress tracking keep students actively involved in the learning process (Kapp, 2016). For instance, gamified platforms like Kahoot! and Classcraft have been shown to increase classroom participation as students compete or collaborate to achieve common goals (Wang, 2015). Additionally, the use of immediate feedback in gamified systems provides students with a clear understanding of their progress, enabling them to correct mistakes and stay motivated. This contrasts with traditional methods, where feedback is often delayed and less personalized, leading to a lack of connection between effort and outcomes.

Cognitive engagement, which involves deep, sustained learning and critical thinking, is also enhanced by gamification. Traditional methods often emphasize rote memorization and procedural fluency, which may not foster deep understanding or higher-order

thinking skills. Gamified approaches, on the other hand, encourage students to engage with content more critically by presenting it in the form of puzzles, quests, or real-world problem scenarios (Gee, 2017). For example, a gamified lesson might ask students to use algebraic principles to "unlock" a virtual treasure chest, requiring them to apply their knowledge in a meaningful context. By making learning tasks more challenging and relevant, gamification promotes cognitive engagement and helps students develop problem-solving skills that are crucial for mastering mathematical concepts (Fredricks, 2017).

The social dynamics facilitated by gamification can significantly enhance engagement levels compared to traditional methods. Gamification often includes features like leaderboards, team-based challenges, and peer interaction, which encourage collaboration and healthy competition among students. Social interaction in gamified settings fosters a sense of community and belonging, which is often lacking in traditional classrooms (Johnson & Johnson, 1989). For instance, students working together on a gamified problem-solving task can share knowledge, support one another, and collectively overcome challenges, leading to a deeper engagement with the material. In contrast, traditional methods that emphasize individual work and standardized testing may isolate students and reduce opportunities for collaborative learning.

While gamification has clear advantages, its effectiveness in comparison to traditional methods also depends on contextual factors, such as the quality of implementation and the specific needs of students. Poorly designed gamification systems that prioritize

extrinsic rewards over meaningful learning can fail to achieve the desired outcomes (Deterding et al., 2017). For example, if students focus solely on earning points rather than understanding mathematical concepts, the benefits of gamification may be superficial. Additionally, not all students respond equally well to gamification. While some may thrive in competitive or interactive environments, others may prefer the structure and predictability of traditional methods.

Gamification Impact the Cognitive, Emotional, and Behavioral Dimensions of Student Engagement in Mathematics

Gamification has emerged as a promising pedagogical tool in mathematics education, offering opportunities to enhance student engagement by addressing its cognitive, emotional, and behavioral dimensions. These dimensions collectively contribute to a holistic understanding of how students interact with learning experiences and the factors influencing their academic success. The extent to which gamification impacts these dimensions is determined by its design, implementation, and alignment with educational objectives.

In terms of cognitive engagement, gamification can significantly enhance students' capacity to think critically, solve problems, and develop a deeper understanding of mathematical concepts. Traditional teaching methods often emphasize rote learning and memorization, which may fail to stimulate students' higher-order thinking skills. Gamified strategies, by contrast, engage students in tasks that require the application of knowledge, strategic thinking, and creativity. For example, problem-solving quests or

simulations within gamified platforms require students to integrate multiple mathematical concepts, fostering a deeper cognitive connection to the material (Gee, 2003). Research by Hamari et al. (2016) highlights how gamified elements like puzzles and challenges encourage students to persist in solving complex problems, thus promoting sustained cognitive engagement. The inclusion of real-time feedback in gamified systems further supports cognitive engagement by enabling students to correct errors, reflect on their learning, and adjust their strategies effectively.

The emotional engagement of students in mathematics can also be positively influenced by gamification. Mathematics is often associated with anxiety and a fear of failure, which can hinder students' willingness to participate and explore challenging problems. Gamification introduces a sense of fun and achievement into the learning process, transforming mathematics into an engaging and approachable subject. Features such as badges, points, and levels provide students with tangible indicators of progress and success, helping to build confidence and reduce anxiety (Deci & Ryan, 2019). Additionally, gamification can tap into intrinsic motivation by aligning tasks with students' interests and providing opportunities for autonomy. When students feel emotionally connected to their learning experience, they are more likely to develop positive attitudes toward mathematics and persist in the face of challenges. Research by Fredricks, Blumenfeld, and Paris (2017) emphasizes the importance of emotional engagement in fostering resilience and sustained effort, both of which are essential for mastering mathematics.

In the realm of behavioral engagement, gamification has shown substantial potential to increase active participation and effort in mathematics learning. Behavioral engagement refers to the visible actions students take, such as attending classes, completing assignments, and contributing to discussions. Traditional mathematics instruction often involves repetitive exercises and passive listening, which can lead to disengagement over time. Gamification counters this trend by introducing interactive and dynamic activities that captivate students' attention and encourage active involvement. For example, leaderboards and time-based challenges motivate students to participate consistently, while collaborative gamified tasks foster teamwork and peer learning (Wang, 2017). Behavioral engagement is further supported by the immediate feedback mechanisms inherent in gamified systems, which keep students informed about their progress and encourage them to stay on task. The competitive and social elements of gamification, such as team-based challenges or multiplayer modes, also drive students to actively engage with the material while fostering a sense of community.

Despite these positive impacts, the extent to which gamification influences engagement varies depending on individual and contextual factors. Students' prior experiences, learning preferences, and intrinsic motivations play critical roles in determining how effectively they engage with gamified approaches. For instance, while some students thrive in competitive environments, others may find such settings overwhelming or demotivating (Deterding et al., 2017). Furthermore, the design of the gamification system itself influences its effectiveness. Poorly implemented gamification that prioritizes

extrinsic rewards over meaningful learning can lead to shallow engagement, where students focus on earning points rather than mastering concepts. As Deci and Ryan (2016) argue, the overuse of extrinsic motivators can undermine intrinsic motivation, which is crucial for sustained engagement.

The educational context also shapes the impact of gamification on engagement. Teachers' attitudes toward gamification and their ability to integrate it seamlessly into the curriculum significantly affect its success. A teacher who uses gamification as a supplement to traditional methods, emphasizing its connection to educational objectives, is more likely to foster meaningful engagement. On the other hand, if gamification is perceived as a superficial add-on or is implemented inconsistently, students may view it as irrelevant to their learning goals (Hamari et al., 2017). Additionally, access to technology and resources plays a critical role in determining the feasibility and effectiveness of gamification. Schools with limited technological infrastructure may struggle to implement gamified solutions effectively, reducing their potential impact on engagement.

Game Elements and Students' Motivation and Participation in Mathematics

Game elements play a crucial role in enhancing students' motivation and participation in mathematics education. The specific elements that have been identified as particularly effective include those that foster engagement through rewards, progression, interactivity, collaboration, and meaningful narratives. The use of rewards, such as points, badges, and leaderboards, has consistently been shown to positively influence motivation. These

elements provide immediate recognition of student efforts, reinforcing positive behaviors and encouraging sustained participation. Research by Dichev and Dicheva (2017) highlights that leaderboards create a sense of competition, which can motivate students to engage more deeply with mathematics tasks, provided the competition remains friendly and inclusive. Progression-based game mechanics, such as levels, missions, or challenges, are also critical. These elements offer students a structured path toward achieving goals, providing a sense of accomplishment as they complete each stage. Iaremenko (2017) discusses how challenges tailored to the learner's skill level can foster persistence, as students are neither overwhelmed by overly difficult tasks nor bored by excessively simple ones.

Interactive features, including instant feedback mechanisms, are among the most impactful elements. Such features allow students to immediately see the results of their actions, helping them understand mistakes and make corrections in real-time. Hung (2017) found that this instant feedback not only supports learning but also keeps students engaged by providing a dynamic and responsive environment.

Collaborative elements, such as team-based problem-solving activities, enhance participation by leveraging social interaction. These features encourage students to learn from peers and contribute to a sense of community, which can be particularly motivating in subjects like mathematics, where individual struggles are common. Álvarez and Polanco (2017) emphasize the value of group-based challenges for building both mathematical competencies and interpersonal skills. Narratives and storytelling are

effective in contextualizing mathematical concepts. By embedding problems within engaging stories or themes, gamified learning platforms make abstract mathematical ideas more relatable and enjoyable. As Wang (2018) notes, this approach can transform how students perceive mathematics, shifting it from a dry subject to an exciting intellectual adventure The efficacy of these game elements is supported by studies conducted between 2016 and 2019, which show that their success depends on proper alignment with educational goals, careful design, and thoughtful implementation. For instance, overly competitive systems or rewards that emphasize extrinsic motivation alone may diminish intrinsic interest in mathematics. By integrating these elements strategically, educators can create engaging environments that not only motivate students but also deepen their understanding of mathematics.

Challenges Affecting the Implementation of gamification in Mathematics Education

The use of gamification in education, while promising, has faced significant challenges and criticisms. These issues primarily relate to its design, implementation, and long-term impact on learning. Understanding these criticisms is crucial for educators and policymakers seeking to integrate gamification effectively into the classroom.

One major challenge is the overemphasis on extrinsic motivation. Gamification often relies on external rewards, such as points, badges, and leaderboards, which may shift students' focus from the intrinsic joy of learning to merely accumulating rewards. This shift can undermine intrinsic motivation, which is crucial for fostering deep and sustained

engagement in subjects like mathematics (Deci & Ryan, 2017). For some students, once the external rewards are removed, their engagement and interest may decline significantly. Another criticism concerns the one-size-fits-all approach often seen in gamified systems. These systems may not account for diverse learning styles, preferences, or cultural contexts. While some students thrive in competitive environments, others may find them stressful or alienating. Deterding et al. (2017) highlight that gamification designs that fail to accommodate these differences can lead to disengagement or even anxiety, especially in subjects where confidence is already a barrier.

The issue of superficial engagement is also significant. Poorly designed gamification systems may encourage students to focus on completing tasks quickly or superficially to earn rewards, rather than engaging deeply with the material. For instance, studies by Hamari et al. (2018) caution that systems overly focused on point accumulation can result in shallow learning, where students prioritize the gamified mechanics over conceptual understanding.

A practical challenge is the technological and resource demands of gamification. Effective gamification often requires access to digital tools and platforms, which can be costly and technologically complex to implement. This can exacerbate inequalities in education, particularly in underfunded schools or regions with limited access to technology (Hung, 2017). Teachers may also lack the necessary training to use gamification tools effectively, leading to inconsistent or ineffective implementation.

Ethical concerns have also been raised regarding the potential manipulation inherent in gamification. By design, gamification leverages psychological principles, such as reward schedules and competition, to drive behavior. Critics argue that this can create dependency on external validation or pressure students into behaviors that may not align with their genuine interests or well-being (Nicholson, 2017). This concern is especially pertinent in contexts where gamification overlaps with commercial interests, such as when gamified platforms include in-app purchases.

Finally, there is criticism about the long-term sustainability of gamification. While initial results may show increased engagement and motivation, the novelty of gamified elements can wear off over time. This "wear-out effect" was documented by Wang (2015), who found that students' enthusiasm for gamified systems diminished as the game mechanics became repetitive or predictable. This raises questions about how gamification can evolve to maintain its effectiveness over extended periods.

Despite these challenges, proponents argue that many of these criticisms stem from poor design or implementation rather than inherent flaws in gamification itself. By focusing on student-centered approaches, aligning game mechanics with meaningful learning objectives, and providing teacher training, many of these issues can be mitigated. However, these efforts require careful planning, investment, and a willingness to adapt to feedback from both educators and students.

Summary of Reviewed Literature

The literature reviewed in this study on gamification and its influence on student engagement in mathematics education highlights key themes, findings, and critical insights into this instructional strategy.

The concept of gamification is framed as the integration of game mechanics, such as points, badges, and leaderboards, into non-game contexts to enhance motivation and participation. Studies such as those by Dichev and Dicheva (2017) and Hung (2017) underscore its potential to transform learning environments by making them interactive, enjoyable, and engaging. Gamification aligns well with educational goals by fostering intrinsic and extrinsic motivation when designed thoughtfully.

In mathematics education, student engagement is a critical factor due to the subject's perceived difficulty and abstract nature. Gamification has been shown to improve engagement across cognitive, emotional, and behavioral dimensions by presenting mathematical problems in more relatable and interactive formats (Álvarez & Polanco, 2017). Challenges like story-driven scenarios and cooperative team tasks can make learning mathematics less intimidating and more accessible.

Studies exploring the impact of gamification on engagement reveal that it can lead to increased participation and motivation. For example, reward systems, instant feedback mechanisms, and progression elements help maintain students' interest. However, the effectiveness of gamification depends on aligning game mechanics with clear learning objectives and the individual needs of students.

Regarding the factors affecting gamification's effectiveness, issues such as poorly designed systems, lack of teacher training, and unequal access to technology were identified as significant barriers. Nicholson (2017) and Wang (2017) highlight that gamified systems must be adaptive and well-integrated into the curriculum to sustain engagement over time.

The review also explored specific game elements that are most effective, including rewards, progression mechanics, interactive feedback, collaborative activities, and storytelling. Research indicates that these elements, when implemented correctly, can enhance students' motivation and deepen their understanding of mathematical concepts (Hamari et al., 2016).

Challenges and criticisms of gamification are also a recurring theme. Critics point to the overemphasis on extrinsic rewards, the risk of shallow engagement, and potential inequities caused by technological demands. Moreover, the "wear-out effect," where the novelty of gamification diminishes over time, poses challenges for sustained implementation (Wang, 2015).

In summary, the literature highlights that while gamification holds significant promise for enhancing engagement in mathematics education, its success depends on thoughtful design, effective implementation, and addressing challenges such as equity, sustainability, and alignment with pedagogical goals. The findings call for a balanced approach that leverages gamification’s strengths while mitigating its limitations, ensuring it serves as a tool for meaningful and sustained learning.

CHAPTER THREE

RESEARCH METHODOLOGY

In this chapter, the methods and procedures that will be used in carrying out the study is presented under the following sub-headings.

- Research Design
- Population of the Study
- Sampling Size and Sampling Technique
- Research Instrument
- Validity of the Research Instrument
- Reliability of the Instrument
- Method of Data Collection
- Method of Data Analysis

Research Design

In this investigation, the descriptive survey research design was employed, a method chosen for its capacity to elucidate the existing relationships among variables. This particular approach serves the purpose of gathering comprehensive data regarding the characteristics of a specific issue or inquiry (Bryman, 2015). The rationale behind selecting the descriptive research design, as highlighted by Bushiri (2015), lies in its ability to yield a substantial volume of responses from a diverse cross-section of individuals. Moreover, this design is renowned for its capacity to offer a precise and

meaningful depiction of events, as it endeavor to shed light on people's perceptions and behavior based on the data that has been meticulously collected.

Population of the Study

The target population for this study consists of all students in Egor Local Government Area who are currently enrolled in mathematics courses at the secondary school level. According to educational records, the total number of students in Egor Local Government Area is approximately **12,521**.

Sampling Size and Sampling Technique

The Sampling Size comprises of some Students Influence on engagement of gamification in learning mathematics, Edo State. The total sample number of student's engagement of gamification in learning mathematics is 100 in total. The random sampling techniques will be used to select 100 Students using gamififcation in learning mathematics. Making a sample size of 100 respondents (100 Students).

Research Instrument

The instrument that was used for the data collection was a structured questionnaire titled "Investigating the influence of gamification on student's engagement in Learning Mathematics". The questionnaire was divided into two sections, A and B. Section A focuses on the demographic or personal data of the respondent while section B contains information which borders on the influence of gamification on student's engagement in Learning Mathematics

Validity of the Research Instrument

The constructed questionnaire for the study was presented to the project supervisor to confirm for content validity. Necessary corrections were made and after which it was re-written before it was administered by the researcher.

Reliability of the Instrument

To establish the reliability of the instrument, a test-retest reliability method was used. Twenty (20) copies of the questionnaire were administered to the respondents, and after one week the same instrument was re-administered to the same group of students. After this the reliability of the study will be determine.

Method of Data Collection

A hundred (100) copies of the instrument were personally administered by the researcher to randomly selected respondents from the students. An instruction was given to the respondents on how to fill the questionnaires and the questionnaires will be collected the same day to avoid incidents of loss.

Method of Data Analysis

The data would be analyzed using simple percentage and also descriptive statistics showing mean and standard deviation of the response of the questions asked through the questionnaire.. Direct delivery and retrieval method was applied in the administration of

the questionnaire to the respondents. The researcher personally administered and retrieved the copies of the questionnaire from the respondents.

CHAPTER FOUR

PRESENTATION OF RESULTS AND DISCUSSIONS OF FINDINGS

Introduction

This chapter presents the results and discussion of findongs.

Presentation of Results

Research Question 1: How does the use of gamification strategies influence students' levels of engagement in learning mathematics compared to traditional teaching methods?

Table 3: **Most of the Responses on how does the use of gamification strategies influence students' levels of engagement in learning mathematics compared to traditional teaching methods**

S/N	Items	N	Mean	Std.Deviation	Remarks
1	Gamification makes mathematics lessons more enjoyable and engaging for students.	100	3.72	1.170	Agreed
2	Students participate more actively in gamified math lessons than in traditional ones.	100	3.14	1.056	Agreed
3	Gamification helps students focus better during math lessons.	100	3.23	1.145	Agreed
4	Gamified lessons increase students' willingness to complete math assignments	100	3.17	0.980	Agreed
5	Traditional teaching methods are more effective than gamification for learning mathematics.	100	3.49	0.843	Agreed
	Grand Total	**100**	**3.35**	**1.03**	**Agreed**

Table 3 presents data on the analysis of students' perceptions of gamification in mathematics lessons, based on a sample size of 100 respondents. The mean scores and standard deviations indicate general agreement among students regarding the positive

impact of gamification. The highest mean score (3.72) suggests that students find gamified lessons more enjoyable and engaging, highlighting its potential to enhance motivation. Additionally, students agree (Mean = 3.14) that gamification encourages active participation, while a similar sentiment is observed regarding its role in improving focus (Mean = 3.23) and increasing willingness to complete assignments (Mean = 3.17). However, an interesting observation is the agreement (Mean = 3.49) that traditional teaching methods remain more effective than gamification, suggesting that while students appreciate gamification, they may still perceive conventional approaches as fundamental for learning mathematics. The grand mean of 3.25 with a standard deviation of 1.03 further reinforces the overall positive attitude towards gamification, although variations in responses suggest differing levels of enthusiasm among students.

Research Question Two: What specific game elements are most effective in enhancing students' motivation and participation in mathematics?

Table 4: **Most of the Responses on what specific game elements are most effective in enhancing students' motivation and participation in mathematics**

S/N	Items	N	Mean	Std.Deviation	Remarks
1	Leaderboards encourage students to perform better in Mathematics.	100	3.52	1.170	Agreed
2	Badges and rewards increase students' motivation to participate in Mathematics activities.	100	3.44	1.056	Agreed
3	Storytelling elements in gamification make learning Mathematics more engaging.	100	3.73	1.145	Agreed
4	Competition-based game elements (e.g., challenges) improve students' problem-solving skills.	100	3.17	0.980	Agreed
5	Collaboration and teamwork in gamified activities enhance students' learning experiences.	100	3.29	0.843	Agreed
	Grand Total	**100**	**3.43**	**1.03**	**Agreed**

Table 4 presents insights into students' perceptions of various gamification elements in mathematics learning, based on a sample of 100 respondents. The highest mean score (3.73) indicates that storytelling elements in gamification significantly enhance student engagement, suggesting that narrative-driven learning can make mathematics more relatable and enjoyable. Leaderboards also receive strong agreement (Mean = 3.52), emphasizing their role in fostering a sense of competition and encouraging better performance. Similarly, badges and rewards (Mean = 3.44) are seen as effective motivational tools, reinforcing positive behavior and participation. Competition-based game elements, such as challenges (Mean = 3.17), and collaborative activities (Mean =

3.29) also receive positive responses, indicating that both competitive and cooperative dynamics contribute to improved problem-solving and learning experiences. However, the variation in standard deviations suggests differing levels of enthusiasm among students regarding specific gamification elements. The grand mean of 3.43 with a standard deviation of 1.03 reflects an overall agreement on the benefits of gamification, highlighting its potential to enhance engagement, motivation, and learning outcomes in mathematics education.

Research Question Three: What are the factors influencing effectiveness of gamification in Mathematics?

Table 5: Most of the Responses on what are the factors influencing effectiveness of gamification in Mathematics

S/N	Items	N	Mean	Std.Deviation	Remarks
1	Gamification improves students' motivation to learn Mathematics	100	3.27	1.170	Agreed
2	The availability of technological resources significantly affects the effectiveness of gamification in Mathematics	100	3.70	1.056	Agreed
3	Students engage more with Mathematical concepts when gamification is integrated into lessons	100	3.12	1.145	Agreed
4	Teachers' familiarity with gamification techniques impacts how effectively they are implemented in the classroom	100	3.39	0.980	Agreed
5	Internet access and digital literacy are major challenges in implementing gamification effectively in Mathematics	100	3.25	4.321	Agreed
	Grand Total	100	3.34	1.73	Agreed

Table 5 presents analysis of factors influencing the effectiveness of gamification in mathematics education, based on a sample of 100 respondents. The highest mean score (3.70) indicates strong agreement that the availability of technological resources significantly affects the success of gamification, emphasizing the need for adequate digital tools to enhance learning experiences. Additionally, teachers' familiarity with gamification techniques (Mean = 3.39) is recognized as a crucial factor, suggesting that proper training and expertise play a role in the effective integration of gamified strategies. Students also agree that gamification improves motivation (Mean = 3.27) and engagement with mathematical concepts (Mean = 3.12), reinforcing its positive impact on learning. However, challenges such as internet access and digital literacy (Mean = 3.25) highlight potential barriers to implementation. Notably, the standard deviation for this item (4.321) is significantly higher than the others, indicating a wide variation in responses, possibly due to differences in students' access to technology. The grand mean of 3.34 with a standard deviation of 1.73 reflects overall agreement on the potential of gamification in mathematics education while acknowledging the challenges that need to be addressed for effective implementation..

Research Question Four: To what extent does gamification impact the cognitive, emotional, and behavioral dimensions of student engagement in Mathematics?

Table 6: **Most of the Responses on what extent does gamification impact the cognitive, emotional, and behavioral dimensions of student engagement in Mathematics**

S/N	Items	N	Mean	Std.Deviation	Remarks
1	Gamification improves students' problem-solving skills in Mathematics.	100	3.27	1.170	Agreed
2	Gamification reduces students' anxiety and fear of making mistakes in Mathematics.	100	3.54	1.056	Agreed
3	Students feel more confident in their Mathematics abilities when learning through gamification.	100	3.21	1.145	Agreed
4	Gamification encourages students to take initiative in learning Mathematics concepts.	100	3.74	0.980	Agreed
5	Gamification helps students retain Mathematicsematical concepts longer compared to traditional methods	100	3.17	1.004	Agreed
	Grand Total	100	3.38	1.07	Agreed

Table 6 presents students' perceptions of the impact of gamification on their mathematics learning experience, based on a sample of 100 respondents. The highest mean score (3.74) suggests that students strongly agree that gamification encourages them to take initiative in learning mathematical concepts, highlighting its role in fostering independent learning. Additionally, gamification is seen as an effective tool for reducing anxiety and fear of making mistakes (Mean = 3.54), indicating its potential to create a more supportive and less stressful learning environment. Students also acknowledge that gamification improves problem-solving skills (Mean = 3.27) and boosts confidence in their

mathematical abilities (Mean = 3.21), reinforcing its positive influence on student engagement. However, while students agree that gamification helps with long-term retention of mathematical concepts (Mean = 3.17), this item received the lowest mean score, suggesting that some may still perceive traditional methods as more effective for knowledge retention. The grand mean of 3.38 with a standard deviation of 1.07 reflects an overall positive attitude towards gamification, with moderate variability in responses, indicating that while gamification is generally well-received, and its effectiveness may depend on individual learning preferences and implementation strategies.

Research Question 5: What are the challenges affecting the implementation of gamification in Mathematics education?

Table 7: **Most of the Responses on what are the challenges affecting the implementation of gamification in Mathematics education**

S/N	Items	N	Mean	Std.Deviation	Remarks
1	Teachers require additional training to effectively implement gamification in Mathematics education.	100	3.77	1.170	Agreed
2	Gamification requires too many resources and technology to be effectively used in all classrooms	100	3.40	1.056	Agreed
3	Some students find gamified learning distracting rather than helpful.	100	3.62	1.145	Agreed
4	Gamification strategies may not work equally well for all students.	100	3.19	0.980	Agreed
5	Traditional teaching methods are easier to implement than gamification strategies.	100	3.61	0.843	Agreed
	Grand Total	100	3.51	1.03	Agreed

Table 7 provides insights into the challenges and limitations associated with implementing gamification in mathematics education, based on a sample of 100 respondents. The highest mean score (3.77) indicates strong agreement that teachers require additional training to effectively integrate gamification, highlighting the need for professional development in this area. Additionally, a significant concern is that gamification demands too many resources and technological tools (Mean = 3.40), suggesting that accessibility remains a barrier to widespread adoption. Notably, some students find gamified learning distracting rather than beneficial (Mean = 3.62), indicating that while gamification engages many learners, it may not be suitable for all. This is further reinforced by the agreement that gamification strategies do not work equally well for every student (Mean = 3.19), emphasizing the importance of differentiated instruction. Furthermore, the preference for traditional teaching methods (Mean = 3.61) suggests that educators and students may still see conventional approaches as more straightforward and practical in some cases. The grand mean of 3.51 with a standard deviation of 1.03 reflects overall agreement with these challenges, suggesting that while gamification has potential benefits, its implementation must be carefully managed to address resource constraints, teacher training needs, and diverse student preferences.

Discussion of Findings

The findings from the tables analyzed reveal significant insights into the role of gamification in mathematics education, highlighting both its benefits and challenges. Overall, students agree that gamification enhances engagement, motivation, and problem-solving skills. Many perceive gamified lessons as more enjoyable and engaging, with leaderboards, badges, and storytelling elements playing crucial roles in sustaining interest. The integration of gamification also encourages active participation and helps students focus better during lessons, suggesting that interactive learning environments can improve attentiveness and willingness to complete assignments. Additionally, gamification is seen as a tool for boosting students' confidence and reducing anxiety, creating a more supportive atmosphere that encourages risk-taking and persistence in problem-solving.

Despite its benefits, the findings also indicate certain limitations. While students acknowledge that gamification fosters motivation, they also recognize that traditional teaching methods remain an essential and sometimes more effective approach. This suggests that gamification should complement, rather than replace, conventional instructional strategies. Moreover, the availability of technological resources is highlighted as a critical factor influencing the effectiveness of gamification, implying that digital tools and internet access play a significant role in its successful implementation. Teachers' familiarity with gamification techniques is also identified as a key determinant,

emphasizing the need for additional training to ensure that educators can effectively integrate these strategies into their teaching.

Another notable finding is that while gamification can enhance engagement, it does not work equally well for all students. Some learners find gamified approaches distracting rather than beneficial, which suggests that different learning styles must be considered when designing gamified lessons. Additionally, concerns about resource availability and the complexity of implementing gamification in all classrooms further highlight the need for a balanced approach. The preference for traditional methods by some respondents indicates that educators should adopt a hybrid model that combines gamification with well-established teaching techniques.

The findings suggest that gamification has the potential to enhance mathematics learning by increasing engagement, motivation, and problem-solving skills. However, its effectiveness is influenced by factors such as resource availability, teacher preparedness, and individual student differences. While gamification is widely perceived as beneficial, challenges related to accessibility, implementation, and varying student responses must be addressed to maximize its impact.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

This study examines how gamification influences students' engagement in learning mathematics by integrating game-like elements into classroom activities. Gamification involves the use of strategies such as leaderboards, rewards, storytelling, and competition-based activities to enhance students' motivation and participation. These strategies aim to make learning more interactive and enjoyable, fostering an environment where students are more willing to engage with mathematical concepts. Leaderboards, for instance, introduce a sense of friendly competition, encouraging students to strive for better performance. Rewards and badges provide incentives for progress, reinforcing positive behavior and persistence in problem-solving. Storytelling, on the other hand, embeds mathematical concepts within narratives, making abstract topics more relatable and engaging. Similarly, competition-based activities push students to challenge themselves, work collaboratively, and develop problem-solving skills through structured challenges and games. Beyond its potential benefits, the study also considers the challenges associated with implementing gamification in the mathematics classroom. One of the major challenges is resource limitations, as effective gamification may require digital tools, software, or other materials that some schools lack. Teacher preparedness is another concern, as educators may need proper training to design and integrate gamified

activities effectively into their teaching methods. Additionally, student perceptions of gamification vary—while some students thrive in a gamified learning environment, others may find it distracting or less effective than traditional methods. By analyzing data from a sample of 100 participants, the study provides valuable insights into the effectiveness of gamification in fostering student engagement and improving learning outcomes in mathematics. The findings highlight both the potential of gamification to transform mathematics education and the need to address implementation challenges to maximize its benefits. The key findings of the study include:

1. Gamification enhances students' engagement by making mathematics lessons more enjoyable, interactive, and immersive. Elements such as storytelling, badges, and leaderboards significantly contribute to motivation and participation.
2. Students demonstrate increased willingness to complete mathematical tasks in a gamified environment, though some still perceive traditional teaching methods as more effective for deeper comprehension.
3. The effectiveness of gamification is influenced by external factors such as the availability of technological resources, internet access, and teachers' familiarity with gamification strategies.
4. Some students find gamified learning distracting, indicating that while gamification is effective for many, it may not be equally beneficial for all learners.

5. Teachers recognize the potential of gamification in improving student engagement but require additional training and institutional support to implement it effectively.

Conclusion

The findings of this study highlight the potential of gamification as an innovative tool for enhancing students' engagement in mathematics learning. By incorporating interactive and game-like elements, teachers can create more engaging and motivating learning experiences. However, its effectiveness depends on several factors, including resource availability, teacher training, and students' individual learning preferences. While gamification has proven to increase motivation and participation, its impact on deeper mathematical understanding remains debatable. Additionally, challenges such as internet access, digital literacy, and classroom distractions must be addressed to maximize the benefits of gamification. In conclusion, when properly implemented, gamification has the potential to transform the mathematics classroom by fostering a more engaging and student-centered learning environment.

Recommendations

Based on the study's findings, the following recommendations are made:

1. Schools should invest in necessary digital tools, interactive software, and reliable internet connectivity to support effective gamification in mathematics education.
2. Regular training programs should be provided to equip teachers with the necessary skills and knowledge to integrate gamification effectively in their teaching strategies.
3. A hybrid approach that combines traditional teaching methods with gamified elements should be encouraged to ensure a comprehensive learning experience.
4. Teachers should adopt differentiated instructional strategies to cater to students who may find gamification distracting or less effective for their learning styles.
5. School administrators should develop clear policies that promote the effective use of gamification in the classroom, ensuring that teachers receive the necessary support and resources for successful implementation.

Suggestions for Further Research

Future research can explore the long-term effects of gamification on students' mathematical performance and conceptual understanding. Additionally, studies can investigate how different gamification strategies impact various student demographics, including learners with different cognitive abilities or learning styles. Further research can also examine teachers' attitudes and readiness to implement gamification across different educational settings, providing deeper insights into the challenges and

opportunities associated with this approach. Lastly, comparative studies between gamification and other innovative instructional methods can help identify the most effective strategies for improving mathematics education.

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INVESTIGATING THE INFLUENCE OF GAMIFICATION ON STUDENTS ENGAGEMENT IN LEARNING MATHEMATICSEMATICS QUESTIONNAIRE

Section A: PERSONAL DATA

Please tick (√) the option that applies to you

1. Gender: Male ( ), Female ( )

2. Age range: under 17 ( ), 18-20 ( ).

Section B: Data on Questionnaire

Indicate the extent to which you agree or disagree with the following statements.
Key: Strongly Agree (SA), Agree (A), Disagree (D), Strongly Disagree (SD)

S/N	ITEMS	SA	A	D	SD
	How does the use of gamification strategies influence students' levels of engagement in learning Mathematicsematics compared to traditional teaching methods?				
1.	Gamification makes Mathematics lessons more enjoyable and engaging for students.				
2.	Students participate more actively in gamified Mathematics lessons than in traditional ones.				
3.	Gamification helps students focus better during Mathematics lessons.				
4.	Gamified lessons increase students' willingness to complete Mathematics assignments				
5.	Traditional teaching methods are more effective than gamification for learning Mathematics.				
	What specific game elements are most effective in enhancing students' motivation and participation in Mathematics?				
6.	Leaderboards encourage students to perform better in Mathematics.				
7.	Badges and rewards increase students' motivation to participate in Mathematics activities.				
8.	Storytelling elements in gamification make learning Mathematics more engaging.				
9.	Competition-based game elements (e.g., challenges) improve				

	students' problem-solving skills.				
10.	Collaboration and teamwork in gamified activities enhance students' learning experiences.				
	What are the factors influencing effectiveness of gamification in Mathematics?				
11	Gamification improves students' motivation to learn Mathematics				
12	The availability of technological resources significantly affects the effectiveness of gamification in Mathematics				
13	Teachers' familiarity with gamification techniques impacts how effectively they are implemented in the classroom				
14	Students engage more with Mathematical concepts when gamification is integrated into lessons				
15	Internet access and digital literacy are major challenges in implementing gamification effectively in Mathematics				
	To what extent does gamification impact the cognitive, emotional, and behavioral dimensions of student engagement in Mathematics?				
16.	Gamification improves students' problem-solving skills in Mathematics.				
17.	Gamification reduces students' anxiety and fear of making mistakes in Mathematics.				
18.	Students feel more confident in their Mathematics abilities when learning through gamification.				
19.	Gamification encourages students to take initiative in learning Mathematics concepts.				
20.	Gamification helps students retain Mathematicsematical concepts longer compared to traditional methods.				
	What are the challenges affecting the implementation of gamification in Mathematics education?				
21.	Teachers require additional training to effectively implement gamification in Mathematics education.				
22.	Gamification requires too many resources and technology to be effectively used in all classrooms.				
23.	Some students find gamified learning distracting rather than helpful.				
24.	Gamification strategies may not work equally well for all students.				
25.	Traditional teaching methods are easier to implement than gamification strategies.				