International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Awareness and Utilization of Game Elements and Techniques in Teaching Mathematics

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Abstract

The study investigated the awareness and utilization of game elements and techniques among junior high school mathematics teachers in the division of Camarines Norte. Key findings revealed that while teachers had a moderate level of awareness of elements like points, leaderboards, certificates, and badges, and techniques like Math bingo, team competitions, logic puzzles, and brainteasers, their actual use of these elements and techniques in the classroom was limited. Techniques such as virtual competitions and experiential learning were less familiar and underutilized by the teachers. This gap was attributed to a lack of training, limited access to technology, and time constraints. The study proposed a training program focused on gamification principles and practical implementation strategies to address these challenges. This initiative aims to enhance teachers' skills and confidence in integrating game elements and techniques into their mathematics instruction, ultimately improving student engagement and learning outcomes.

Keywords: Game Elements; Game Techniques; Gamification; Mathematics; Awareness; Utilization; Barriers; Training Program

I. INTRODUCTION

21st-century skills are the core skills that learners need to know to be successful in today's world, such as how to work together, use technology, think critically, and solve problems. For students to have these skills, teachers should be able to create exciting content that makes students want to learn helpful information for the future. Applying game elements and techniques can be a fun way to learn about them. This is called "gamification," which is the application of game elements and techniques, including points, levels, and rewards, to contexts unrelated to games to foster engagement and improve learning outcomes (Cabezas et al., 2024).

Gamification in education transforms the classroom and everyday activities into engaging game-like experiences (Haiken, 2021). It necessitates imagination, teamwork, and fun. It encourages creativity, cooperation, and enjoyment. In education, gamification can involve using points, leaderboards, badges, challenges, and quests to transform traditional learning environments into more interactive and engaging spaces (Kapp, 2012). These game elements and techniques are designed to tap into students' intrinsic and extrinsic motivations, encouraging deeper participation and persistence in learning tasks (Hamari et al., 2015). While game elements and techniques have gained popularity in education globally, their awareness and utilization in the specific context of teaching mathematics remain underexplored, particularly in the Philippines.

Mathematics is a unique subject that fosters critical thinking in its students. Today, mathematics is highly valued and remains foundational to many other disciplines. Many students have long perceived

mathematics as challenging, often associated with anxiety and a lack of interest. Traditional teaching methods, heavily reliant on memorization and repetitive problem-solving, may not adequately cater to students' diverse learning styles or promote a profound comprehension of mathematical concepts. In this context, gamification offers a dynamic and interactive learning environment that can make mathematics more accessible and enjoyable (Antonio et al., 2022). By incorporating game elements and techniques in teaching mathematics, educators can foster a more dynamic learning environment that promotes more profound engagement with mathematical concepts (Kiili et al., 2018).

Multiple academic studies have demonstrated the effectiveness of gamification in educational environments. It has been found that integrating game elements and techniques in teaching instruction is the best teaching strategy for motivating students to be engaged and productive in learning Mathematics. Evidence shows that gamification positively affects students' motivation, engagement, and learning results. Another study by Zainuddin et al. (2020) highlighted the positive impact of gamification on students' attitudes towards mathematics and their overall learning experience. These findings suggest that integrating game elements and techniques in mathematics offers potential benefits, including increased student motivation, improved problem-solving skills, and enhanced peer collaboration.

Nevertheless, despite the potential advantages, integrating game elements and techniques in teaching mathematics has not yet become prevalent. The awareness and utilization of game elements and techniques among mathematics teachers remain relatively unexplored.

This study seeks to expand the understanding of gamification in mathematics education by describing educators' current level of awareness of these game elements and techniques, determining the extent of their utilization, analyzing the barriers that hinder their awareness and utilization, and proposing a training program to enhance mathematics teachers' skills and confidence in using game elements and techniques.

The findings from this study can potentially contribute to positive social change by improving student engagement and motivation in mathematics. Increased engagement in mathematics can lead to higher graduation rates, as students are more likely to persist and succeed in their studies when they find the subject enjoyable and rewarding (Cabezas et al., 2024b). Furthermore, fostering greater mathematical literacy through gamified learning can open up improved career opportunities for students, especially in STEM-related fields (Antonio et al., 2022). A more mathematically literate population is essential for national development, as it equips individuals with the critical thinking and problem-solving skills necessary for success in a rapidly changing, technology-driven world (Medico et al., 2023). Therefore, this research not only addresses an academic gap but also has the potential to create broader social benefits by promoting mathematical proficiency and enhancing students' prospects. By shedding light on these aspects, this research aims to offer practical recommendations and valuable insights into effectively integrating gamification in mathematics education.

This study contributes to educational innovation by providing insights into the use of game elements and techniques in mathematics classrooms in the Philippines. By understanding the current levels of awareness and utilization and the challenges teachers face, this research will support the development of professional development programs that equip teachers to implement gamification effectively. This research aims to promote better student engagement, higher graduation rates, and a more mathematically literate population, leading to positive social change through improved educational outcomes. Finally, this research laid the groundwork for future studies on gamification in education, particularly the use of game elements and techniques in mathematics, which contributes to the broader effort to innovate teaching practices and enhance student learning.

A. Scope and Delimitation

This research focused on the awareness and utilization of game elements and techniques among junior high school (JHS) mathematics teachers in selected public secondary schools within the Division of Camarines Norte with sufficient mathematics teachers.

Information was gathered using a survey questionnaire administered during the first two weeks of September. The study was limited by its small sample size and geographic scope. It included teachers from 2-3 schools per district across 11 districts where mathematics teachers were sufficiently and willingly available.

The study was limited to only JHS mathematics teachers in public schools, excluding private schools and other subject areas. It focused on the teachers' awareness and utilization, including the barriers, not the effectiveness of these elements and techniques on student performance. It does not include factors such as the long-term impacts of gamification on student achievements or comparisons across other subjects outside of Mathematics.

Additionally, while the study proposed a professional development program for teachers, it did not assess this program's actual implementation or effectiveness within the school.

B. Objectives of the Study

This study investigated the current use of game elements and techniques in mathematics education, focusing on teachers' awareness, utilization, and barriers. The researcher proposed a training program to address challenges and effectively enhance teachers' abilities to implement game elements and techniques in teaching mathematics.

Specifically, this study addressed the following objectives:

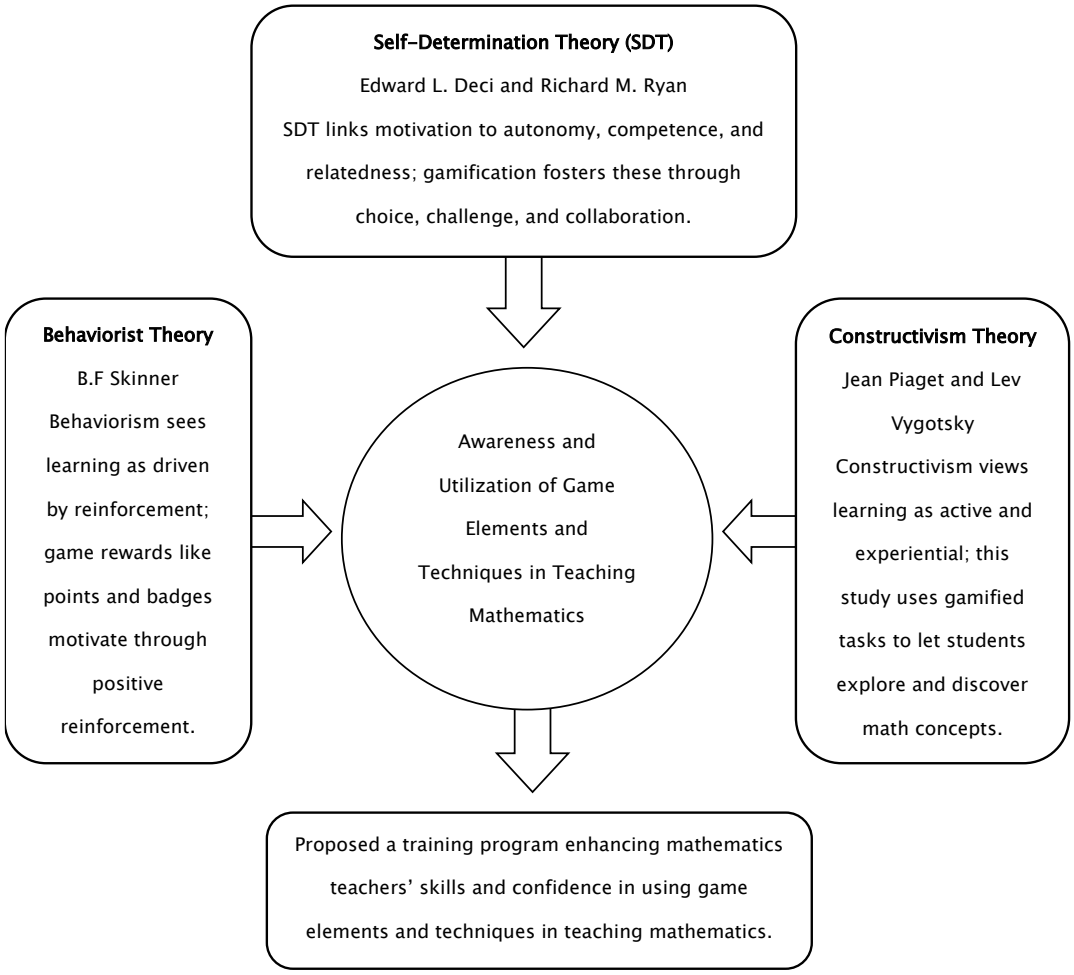
1. Describe mathematics teachers' level of awareness of game elements and techniques in teaching Mathematics.
2. Determine the extent of utilization of game elements and techniques in teaching Mathematics.
3. Analyze the barriers to mathematics teachers' awareness and utilization of different game elements and techniques, and
4. Propose a training program enhancing mathematics teachers' skills and confidence in using game elements and techniques in teaching Mathematics.

C. Framework

As presented in Figure 1, this study's theoretical framework integrated vital theories of learning, motivation, and technology acceptance to explore the awareness and utilization of game elements and techniques in teaching mathematics. The theories were informed by the theories of constructivism, operant conditioning, and self-determination, which provided insights into how gamification strategies can enhance engagement and improve learning outcomes.

Figure 1

Theoretical Paradigm



Constructivist Theory

Constructivist theories, particularly those developed by Jean Piaget (1976) and Lev Vygotsky (1978), are foundational to understanding gamified learning environments. Piaget's theory stresses how important learning is by doing and making discoveries, where students build knowledge through experiences and interactions. In a gamified classroom, students engage in interactive, hands-on activities requiring them to solve problems, explore concepts, and apply mathematical principles dynamically. This active engagement helps to solidify their understanding and retention of mathematical concepts.

Vygotsky's theory, on the other hand, underscores the significance of social interaction and scaffolding in learning. Gamified environments often incorporate collaborative techniques, such as team challenges and peer-assisted learning, facilitating social learning and peer support. This aligns with Vygotsky's idea that the Zone of Proximal Development (ZPD) is where students learn more effectively with the help of more knowledgeable peers or instructors. By integrating social elements into the learning process, gamification, particularly games and techniques, can create a more engaging and encouraging learning atmosphere,

fostering more advanced knowledge and skill development (Define Cooperative Learning in Education, 2022).

Behaviorist Theory

Behaviorist theories, such as those proposed by B.F. Skinner (1953) focused on reinforcement and rewards as key motivators for learning. Gamification leverages
behaviorist principles by providing immediate feedback and rewards to encourage desired behaviors and content mastery. For instance, students can earn points, badges, or other forms of recognition for completing tasks, achieving high scores, or demonstrating improvement. These rewards are positive reinforcement, motivating students to continue engaging with the material and striving for excellence. The immediate feedback provided in gamified environments helps students recognize their progress, identify areas for improvement, and stay motivated throughout the learning process.

Self-Determination Theory

Self-determination theory (SDT) by Deci and Ryan (1985) highlights intrinsic motivation and the need for competence, autonomy, and relatedness. Gamified learning environments are designed to foster these intrinsic needs by offering students opportunities to feel competent through mastering challenges, autonomous by making choices about their learning paths, and related through social interactions and collaboration. By satisfying these psychological needs, gamification can enhance students' motivation to learn mathematics, leading to more sustained and meaningful engagement.

Integrating constructivist and behaviorist theories, the Self-Determination Theory provides a robust theoretical framework for examining the awareness and utilization of gamified teaching approaches in mathematics. This framework highlights the importance of active and social learning, motivation through rewards, intrinsic motivation, and technology's ease of use and perceived usefulness. By leveraging these theoretical perspectives, this study aims to provide insights into how game elements and techniques can enhance mathematical learning and the factors that influence their adoption by educators.

D. Materials and Methods

This study employed a descriptive survey research design to investigate mathematics teachers' awareness, utilization, and barriers to game elements and techniques. Questionnaires were utilized as the primary data collection instrument.

This study used a purposive sampling technique to focus on one hundred (n=100) public secondary Mathematics teachers from selected divisions of Camarines Norte schools. The research ensures that the participants are mathematics teachers from public JHS in the selected schools.

The research instrument was a structured questionnaire designed by the researcher, the Game Elements and Techniques in Teaching Mathematics Questionnaire (GETTMQ). The questionnaire consisted of four main sections: Section 1 was based on demographic information (age, gender, years in service, teaching position, educational background). Section 2 focused on awareness of the six identified game elements and 14 game techniques in teaching mathematics, with a 4-option rating scale of Fully Aware, Aware, Slightly Aware, and Not Aware at all. Section 3: Utilization of gamified teaching approaches. It had a 4-point option scale of Always used, frequently used, rarely used, and never used. Section 4 focused on barriers to awareness and utilization, including two open-ended questions.

Data was collected and analyzed using descriptive statistics (e.g., percentage, mean, frequency, and ranking) for quantitative data and thematic analysis for open-ended responses. The thematic analysis involved identifying common themes, patterns, and categories within the qualitative data to better understand the respondents' perspectives.

By employing these methods and procedures, the study aimed to comprehensively understand mathematics teachers' awareness, utilization, and barriers to game elements and techniques in teaching mathematics within the Division of Camarines Norte.

E. Results And Discussions

Awareness of Game Elements and Techniques

Gamification is a prevalent trend in mathematics instruction and learning. Using game elements and techniques in classes can be a good substitute when teachers have less time to help students raise their mathematical competency. Game elements refer to the individual components integrated into instructional design to copy the structure of games. On the other hand, game techniques encompass the methods or strategies used to employ these elements effectively in the learning process, which are part of gamification. This study assessed the teachers' awareness of game elements and techniques, shown in Table 1.

Generally, the results revealed that the teachers are aware of the game elements and techniques, with an overall mean of 2.81. This means that the teachers have ample understanding of the game elements and techniques, but not to the point of reaching the highest level of awareness. In terms of game elements, the mean is 2.87, interpreted as aware, while in terms of game techniques, the mean is 2.78, interpreted as aware. Certain patterns in the awareness levels of specific elements and techniques indicate variations in familiarity, reflecting the influence of traditional and modern educational practices.

TABLE 1

Mathematics teachers' level of awareness of the Game Elements and Techniques.

Game Elements	Mean	Interpretation
Points System	3.08	Aware
Badges and Certificates	2.93	Aware
Leaderboards	3.00	Aware
Challenges and rewards	2.98	Aware
Progress bars	2.69	Aware
Timed puzzle locks	2.51	Aware
Mean	**2.87**	**Aware**
Game Techniques	Mean	Interpretation
Quests with tasks	2.96	Aware
Logic puzzles and brainteasers	2.97	Aware
Escape room activities	2.79	Aware
Interactive simulations	2.88	Aware
Classroom economy for classroom rewards	2.68	Aware
Math choice boards	2.73	Aware
Team competitions	3.00	Aware

Virtual competitions	2.46	Slightly Aware
Scavenger hunt	2.69	Aware
Mystery-based learning	2.74	Aware
Flashcard battles	2.93	Aware
Mission boards	2.61	Aware
Virtual experiential learning	2.45	Slightly Aware
Math bingo	3.06	Aware
Mean	**2.78**	**Aware**
OVERALL	**2.81**	**Aware**

Legend: *3.50-4.00* *Highly Aware*
2.50-3.49 *Aware*
1.50-2.49 *Slightly Aware*
1.00-1.49 *Not Aware at all*

Teachers have moderate awareness of game elements, with a mean of 2.81, and a stronger familiarity with traditional methods like points, leaderboards, and rewards, with a mean of 2.87. However, their awareness of digital techniques, such as virtual experiential learning and competitions, with a mean of 2.78, is lower, likely due to limited access to technology. Traditional game techniques like Math Bingo and logic puzzles are more commonly known, while newer, tech-based methods are less familiar.

Utilization of Game Elements and Techniques

Incorporating gamification into math instruction can significantly enhance student engagement and learning. Teachers can create a more enjoyable and motivating learning environment by combining elements and techniques of games. Table 2 shows teachers' utilization of game elements and techniques in teaching Mathematics. Generally, the teachers rarely used the game elements and techniques, with a mean of 2.35. This means the teachers have little experience using game elements and techniques in mathematics. This indicates that teachers face some barriers to utilizing game elements and techniques. This may be attributed to insufficient facilities for gamification. This also suggests that while teachers may be aware of various game elements and techniques, implementing these strategies in the classroom remains limited. In terms of game elements, the mean is 2.51, interpreted as frequently used, while in terms of game techniques, the mean is 2.24, interpreted as rarely used.

TABLE 2

Utilization of Game Elements and Techniques in Teaching Mathematics.

Game Elements	Mean	Interpretation
Points System	2.93	Frequently Used
Badges and Certificates	2.57	Frequently Used
Leaderboards	2.65	Frequently Used
Challenges and rewards	2.68	Frequently Used
Progress bars	2.23	Rarely Used
Timed puzzle locks	2.00	Rarely Used
Mean	**2.87**	**Aware**

Game Techniques	Mean	Interpretation
Quests with tasks	2.75	Rarely Used
Logic puzzles and brainteasers	2.57	Rarely Used
Escape room activities	2.29	Rarely Used
Interactive simulations	2.25	Rarely Used
Classroom economy for classroom rewards	2.16	Rarely Used
Math choice boards	2.20	Rarely Used
Team competitions	2.45	Rarely Used
Virtual competitions	1.97	Rarely Used
Scavenger hunt	2.12	Rarely Used
Mystery-based learning	2.30	Rarely Used
Flashcard battles	2.26	Rarely Used
Mission boards	2.13	Rarely Used
Virtual experiential learning	2.04	Rarely Used
Math bingo	2.44	Rarely Used
Mean	**2.24**	**Rarely Used**
OVERALL	**2.35**	**Rarely Used**

Legend: *3.50-4.00* *Always used*
2.50-3.49 *Frequently used*
1.50-2.49 *Rarely used*
1.00-1.49 *Never used*

Teachers frequently use basic gamification elements like point systems, rewards, and leaderboards, with less frequent use of more complex elements such as progress bars and timed puzzles, with a mean score of 2.51. Immersive techniques, including interactive simulations and virtual competitions, are rarely utilized, with a mean score of 2.24. Overall, teachers are more likely to integrate traditional, familiar gamification methods, while more advanced, tech-dependent techniques remain underutilized due to perceived barriers, with a mean score of 2.35.

Barriers to Utilization of Game Elements and Techniques

The researcher used two open-ended questions to explore the challenges and support needs of implementing game elements and techniques in mathematics instruction. Teachers recognized barriers including restricted access to technology, time limitations, and inadequate training, which considerably hinder their ability to incorporate gamified strategies into their teaching practices successfully. The necessity for targeted professional development, resource allocation, and mentorship was emphasized as essential mechanisms to address these challenges. The responses were classified into two themes: Barriers Encountered and Professional Support, as Tables 3 and 4 outlined.

TABLE 3

Barriers to Awareness and Utilization of Game Elements and Techniques

Theme	Code	Sample Responses
Technological and Resource Limitations	Internet Connectivity	"Our school does not have a stable internet connection, which makes it hard to use online games or apps." – Teacher 12
	Access to Devices	"We do not have enough computers or tablets. Without a projector, it is hard to visually present game techniques and activities to the whole class." – Teacher 6
	Software and Tools	"The free educational games do not have all the features needed for instruction. We need access to paid versions." – Teacher 33
Time Constraints and Curriculum Demands	Limited Class Time	"The 45-minute class schedule in the new MATATAG curriculum makes it difficult to fit gamified lessons, which can take longer than traditional ones." – Teacher 51
	Preparation and Planning Time	"It takes too much time to plan and adapt traditional lessons into gamified formats, which is not feasible with our workload." – Teacher 62
	Curriculum Alignment	"Ensuring that the gamified activities align directly with curriculum standards and objectives is challenging." – Teacher 51
Student Engagement and Learning Diversity	Varied Student Responses	"Some students love the competition, but others find it stressful or uninteresting, leading to disengagement." – Teacher 73
	Differentiation Challenges	"While some students excel, others, especially those with slower learning speeds, struggle to keep up with gamified lessons." – Teacher 81
	Behavioral and Classroom Management	"The excitement generated by gamified activities can lead to

Theme	Code	Sample Responses
		disruptive behavior, especially among competitive students." – Teacher 85
Lack of Professional Development and Teacher Training	Insufficient Training	"I do not know enough about gamification or how to apply it effectively. We have not had proper training." – Teacher 89
	Teacher Confidence	"Without training, I do not feel confident using gamified methods, so I stick to traditional approaches." – Teacher 90
Cultural and Institutional Barriers	Resistance to Change	"Some students and teachers are resistant to gamified teaching methods, preferring traditional lecture-based instruction." – Teacher 95
	Lack of Administrative Support	"We do not get enough support from the administration to use gamification, which limits what we can do." – Teacher 99

Professional Development and Support Resources for Overcoming Barriers to Gamification

Table 4 outlines the professional development and support resources identified to reduce barriers to the implementation of gamification in education. The findings are categorized into seven themes: These themes summarize strategies and approaches suggested by teachers to improve their ability to integrate gamification effectively.

The findings emphasize the need for targeted workshops, mentorship, and accessible resources to support gamified teaching. They highlight the role of technology, time management, and resource availability in enabling effective gamification. Table 5 offers a framework for professional development tailored to teachers' practical needs.

TABLE 4

Professional Development and Support Resources for Overcoming Barriers to Gamification

Theme	Code	Sample Responses
Technology and Educational Tools Training	Workshops on Gamified Platforms	"Workshops on Kahoot! Quizizz and Prodigy Math would help us integrate these platforms into our math curriculum effectively." – Teacher 2
	EdTech Training	"We need training on using digital tools like Minecraft Education and Quizizz to integrate technology seamlessly into our lessons." – Teacher 11
Mentorship and Peer Coaching	Mentorship Programs	"Pairing with experienced teachers who have successfully implemented gamification can help us understand best practices." – Teacher 18
	Peer Coaching and Collaboration Networks	"Creating a peer coaching system or collaboration network would allow us to share ideas and strategies for gamified teaching." – Teacher 29
Instructional Design Workshops on Gamification	Hands-on Gamification Workshops	"Workshops where we experience gamified lessons as students would help us understand how to design our game-based lessons." – Teacher 31
	Workshops on Lesson Planning and Gamification	"Workshops that offer ready-to-use templates and gamified lesson plans would save us time and help with planning." – Teacher 38
Time Allocation and Support for Gamified Lessons	Curriculum Alignment and Time Allocation	"We need dedicated time to explore and implement gamification without rushing through a packed syllabus." – Teacher 44
Ready-Made Resources and Templates	Pre-Designed Gamified Lessons	"Access to pre-designed, curriculum-aligned gamified lesson plans would make it much easier to implement gamified teaching." – Teacher 50
Training on Low-Tech or No-Tech Gamification	Low-Tech Gamification	"We need training on creating gamified activities that require minimal technology, such as paper-based games or physical manipulatives." – Teacher 86

Mathematics teachers face significant barriers to implementing game elements and techniques, including limited access to technology, insufficient training, and resistance to change. These contribute to low confidence and knowledge gaps, particularly in using more advanced, technology-driven methods like virtual competitions and experiential learning.

Propose a training program enhancing mathematics teachers' skills and confidence in using game elements and techniques in teaching Mathematics.

TABLE 5

Professional Development Training Program on Game Elements and Techniques in Mathematics

Parts	Features
Inputs	• Identified needs: low awareness, limited utilization, lack of training, low confidence, and resource gaps among mathematics teachers. • Participants: 52 JHS mathematics teachers from 13 districts in the Division of Camarines Norte. • Tools: Needs assessment surveys/interviews. • Support: Php 50,000 budget from MOOE; logistical support including venue, equipment, internet, and materials. • Experts: Facilitators with experience in gamification and classroom application.
Process	• Step 1: Needs assessment to identify gaps and barriers. • Step 2: Data analysis to shape training content. • Step 3: Setting program objectives aligned with findings. • Step 4: Designing training with theory and practice (e.g., Kahoot!, Quizizz, low-tech strategies, assessment, classroom management). • Step 5: Planning logistics (venue, tech, materials, schedule). • Step 6: Collaborating with gamification experts and educators.
Output	• Improved awareness and understanding of game elements and techniques. • Development of gamified lesson plans tailored to real classroom settings. • Increased teacher confidence and capability in implementing gamified instruction. • Hands-on experience with both digital and low-tech strategies. • Creation of a peer support system through coaching and collaborative activities. • Anticipated improvements in student engagement, motivation, and learning outcomes.

The development of the professional training program, Enhancing Awareness and Utilization: Empowering Mathematics Teachers in Gamified Teaching Elements and Techniques, follows a systematic framework that includes input, process, and output components as provided in Table 5.

The input phase encompasses a needs assessment to identify barriers such as low awareness, limited resources, and lack of confidence. The process involves carefully structured sessions, beginning with fundamental gamification principles and concluding with practical application through gamified lesson design, demonstration teaching, and collaboration workshops. Assessments conducted before and after training, coupled with reflective feedback, facilitate ongoing learning and program enhancement.

The result is a group of mathematics teachers who possess actionable strategies, increase confidence, and the necessary tools to convert classrooms into engaging, gamified learning environments, thereby enhancing student motivation and outcomes.

Inputs

The increasing demand for innovative teaching methods in mathematics education has led to a greater adoption of game elements and techniques. Gamification provides a practical approach enhancing student engagement, increasing motivation, and promoting deeper learning.

Despite the potential benefits, many mathematics teachers struggle to incorporate these game elements and techniques within their classrooms. The program addresses the study's objectives by describing mathematics teachers' level of awareness of game elements and techniques in teaching Mathematics, determining the extent of utilizing game elements and strategies, and analyzing the barriers to mathematics teachers' understanding and utilization of different game elements and techniques.

These objectives are reflected in the program's input phase, which begins with a needs assessment that identifies gaps in awareness, utilization, and resources. Surveys and interviews reveal low awareness, limited use of gamified strategies, and key barriers such as lack of resources, confidence, and training.

The training program is then designed to address these issues, incorporating gamification principles, practical applications, low-tech strategies, classroom management techniques, and assessment methods within gamified frameworks. This ensures that the program directly tackles the objectives by equipping participants with actionable strategies to enhance engagement and learning outcomes in mathematics.

The proposed professional development program, "Enhancing Awareness and Utilization: Empowering Mathematics Teachers to Overcome Barriers to Gamified Teaching Elements and Techniques," is organized per the standard format established by the Department of Education (DepEd). This format guarantees alignment with DepEd's guidelines for professional development initiatives, thereby ensuring relevance, sustainability, and effectiveness in meeting teachers' needs.

The input for the professional development program encompasses several essential elements that contribute to the initiative's overall structure and success. A needs assessment was conducted to understand teachers' challenges in integrating game elements and techniques into their mathematics instruction. Data from surveys and interviews revealed low awareness, and most elements and techniques were rarely utilized.

Key barriers such as limited resources, lack of confidence in technology, and inadequate training hinder their awareness and utilization. Furthermore, teachers expressed a desire to engage students more actively in learning, especially in mathematics, which is often perceived as challenging. The content also addresses classroom management techniques to maintain student engagement in competitive environments and methods for assessing student performance within gamified frameworks.

These components form the program's foundation, ensuring participants leave with actionable strategies to enhance student engagement and learning outcomes in mathematics.

The Professional Development Training Program on Gamified Teaching Elements and Techniques in Teaching Mathematics is a three-day training initiative. This program is designed to empower and equip mathematics teachers with the knowledge, skills, and confidence to effectively integrate gamified teaching elements and techniques into their classrooms. Scheduled from February 27 to 29, 2026, at San Francisco National High School, the training will involve 52 mathematics teachers from the 13 divisions of the Camarines Norte District. The program's proponent is John Michael D. Factor, a San Francisco National High School Teacher III.

The participants' existing knowledge and teaching practices shape how the program is delivered, ensuring that each teacher gains confidence and competence in using gamified strategies effectively, regardless of their starting point. The program is supported by a comprehensive management team consisting of steering, planning, technical, and administrative committees, all of which ensure the smooth operation of the training. Facilitators will provide hands-on guidance, and peer coaching sessions will encourage collaboration and sharing of best practices among participants. The program's budget is Php 50,000, funded through the school's Maintenance and Other Operating Expenses (MOOE). This covers materials, resources, and meals for the 52 participants.

The facilitators and experts also play a vital role in the input phase. The program will be led by experienced teachers and specialists in gamification, ensuring the content is relevant and applicable to real-world classroom settings.

These facilitators will guide participants through theoretical discussions and practical applications, offering their expertise in troubleshooting challenges, managing classroom dynamics in gamified settings, and designing lesson plans using game elements. Their experience in successfully implementing gamified techniques in their class provides valuable insights that help bridge the gap between theory and practice.

Finally, logistical support plays a vital role in the input phase. The training will occur on-site at San Francisco National High School, and necessary technology such as laptops, projectors, and internet access will facilitate interactive sessions. This ensures the learning environment is conducive to theoretical discussions and hands-on activities.

Process

The proposed training program was developed through a systematic process to ensure that it was responsive to the actual needs of junior high school mathematics teachers. The process started with a needs assessment, followed by data analysis, and ended with a targeted intervention. Each step aimed to identify gaps in awareness, utilization, and barriers, ensuring the training program is data-driven, relevant, and practical for classroom use.

Step 1: Conducting the Needs Assessment. The development of the professional development training program began with a comprehensive needs assessment. To gather data, a questionnaire with open-ended questions was conducted with junior high school mathematics teachers in the Division of Camarines Norte. These methods aimed to address the study objectives: describing the level of awareness of game elements and techniques, determining their extent of utilization, and identifying barriers to implementation.

Findings revealed that most teachers were unaware of and rarely used gamification in their classrooms due to limited resources, lack of confidence, and inadequate training. These results highlighted the key

areas that needed intervention, provided the foundation for the training program's design, ensuring that each component directly addressed the teachers' identified needs and challenges.

Step 2: Analyzing the Results. After collecting the data, the results were analyzed to identify trends and align them with the study objectives. Barriers such as insufficient technical skills, resistance to innovation, and the absence of gamified resources were categorized and prioritized. This analysis informed the specific content areas and activities of the training program. Furthermore, insights from the data ensured that the program would directly address the teachers' challenges and gaps.

Step 3: Setting the Objectives. The next step was setting clear objectives for the training program. These objectives were directly derived from the study's findings. They included increasing teachers' awareness of game elements and techniques, improving their ability to utilize gamification effectively, overcoming identified barriers, and empowering teachers to create more engaging mathematics lessons. The training was designed to be outcome-driven and responsive to the participants' specific situations by aligning the program goals with the identified needs.

Step 4: Designing the Training Proposal. A well-structured proposal was then designed to incorporate both theoretical and practical components. The training content included an introduction to gamification principles, hands-on workshops on gamified tools like Kahoot! and Quizizz, and strategies for using low-tech gamification for resource-limited classrooms.

Additionally, the training covered classroom management techniques for competitive settings, assessment within gamified frameworks, and collaborative lesson planning. This comprehensive approach ensured that teachers would leave the program equipped with actionable strategies they could apply immediately in their teaching practices.

Step 5: Planning the Logistics. Logistical planning followed, ensuring the smooth delivery of the training program. San Francisco National High School was selected as the venue, and the training was scheduled from February 27 to 30, 2025. Necessary materials, equipment such as laptops and projectors, and internet access were secured. The program's PHP 50,000 budget, sourced from the school's Maintenance and Other Operating Expenses (MOOE), covered materials, meals, and other operational costs. This meticulous preparation guaranteed that all resources were in place for a practical training experience.

Step 6: Collaborating with Experts. Lastly, collaboration with experts and experienced educators was integral to the program's development. Specialists in gamification and innovative teaching techniques were consulted to refine the training program, ensuring its relevance and applicability. This collaborative effort ensured that the training program would be practical, actionable, and beneficial for participants.

Output

The proposed training program is designed to achieve transformative outcomes in mathematics instruction by equipping teachers with the gamified tools, knowledge, and confidence to integrate gamified strategies effectively into their classrooms.

A significant output of the program is the anticipated enhancement in teachers' awareness and understanding of game elements and techniques. Participants will develop a strong foundation in gamification principles, enabling them to recognize the benefits of these strategies for increasing student engagement and motivation in mathematics.

One of the program's standout features is its emphasis on practical application. Teachers are expected to create and implement gamified lesson plans during the training, bridging the gap between theory and practice. These lesson plans will demonstrate the integration of low-tech solutions. This dual approach

ensures that the strategies are accessible and adaptable to varied classroom contexts, addressing barriers to technology access and resource availability.

The program also aims to build teachers' confidence in gamification by providing hands-on experience with traditional and advanced techniques. Participants will engage in peer coaching, collaborative planning, and demonstration teaching, which foster a supportive learning environment and promote professional growth. These sessions encourage knowledge-sharing and practical skill development, creating a foundation for encouraging sustained use of gamification in teaching.

Addressing barriers is a central feature of the program. It provides targeted strategies to overcome challenges such as time constraints, limited resources, and classroom management. Teachers will leave the training with actionable solutions and a clearer understanding of tailoring gamified strategies to meet diverse student needs.

The program's broader impact includes fostering a collaborative community of practice among mathematics teachers. Through peer interactions, professional learning, and ongoing mentoring, the program ensures participants have continuous support and opportunities to refine their gamified teaching approaches. This collaboration extends beyond the training, promoting a culture of innovation and shared learning within schools and districts.

Ultimately, the program is expected to enhance students' learning experiences. Teachers with gamification skills can create engaging and interactive lessons that make mathematics more accessible and enjoyable. Initial feedback from participants' classrooms is anticipated to show heightened student engagement, motivation, and performance in mathematics.

The program's structured, sustainable design makes it a strong model for expanding gamification training across subjects. Its practical focus, dual strategy approach, collaborative framework, and emphasis on overcoming barriers ensure effective implementation and support long-term educational improvement.

II. CONCLUSIONS

Awareness of Game Elements: Teachers are familiar with traditional game elements like points, leaderboards, and rewards, as these elements have long been integrated into classroom practice in various ways. These elements are easy to use and implement without requiring advanced technology or training, but lack awareness of advanced, tech-based techniques like virtual competitions and experiential learning due to limited exposure to technology, insufficient training, and they remain unaware or hesitant to adopt these elements in the teaching and learning process. This highlights the need to expand their understanding of modern gamification to better integrate technology into mathematics instruction.

Utilization of Game Techniques: Teachers primarily use accessible and traditional gamification elements, such as point systems and leaderboards, which are well-integrated into classroom practices. However, the overall low utilization of more advanced and immersive techniques, with a mean score of 2.35, suggests that gamification is still in its early stages of implementation, with challenges in integrating digital tools due to limited training and experience. While some teachers attempt to incorporate basic game elements and techniques, the broader and impactful use remains underutilized. The hesitation often came from the uncertainty and several barriers, including insufficient training, time management, and a lack of technological resources. Consequently, the potential of game elements and techniques in improving student engagement and achievement is not fully realized in the classroom.

The barriers to mathematics teachers' awareness and utilization of game elements and techniques are largely due to limited training, time, and resources. Many teachers are interested in gamified teaching but

lack the professional development and support to apply it effectively. Time constraints and a lack of technological access further discourage them from exploring these elements and techniques. In addition, the absence of support hinders teachers' adoption of these innovative approaches. These barriers highlight the need for structured training, practical tools, and a supportive environment to help teachers confidently use game elements and techniques in teaching mathematics.

III. RECOMMENDATIONS

The study's findings can be used to offer practical recommendations and valuable insights into effectively integrating gamification in mathematics education. The study will contribute to educational innovation by providing insights into the use of game elements and techniques in mathematics classrooms in the Philippines. Future studies may increase the number of respondents to get a general perspective as the study is limited to public secondary schools in Camarines Norte, not enough to represent the entire number of teachers in Camarines Norte Division and to implement the program's effectiveness to address the gap between awareness and utilization of teachers to game elements and techniques in teaching mathematics. Moreover, it is also recommended that schools should prioritize professional development by organizing targeted training sessions. Additionally, infrastructure investment is crucial; schools must improve access to technology by providing reliable internet, updated devices, and interactive tools to support the integration of digital game techniques. Furthermore, establishing continuous support mechanisms such as peer mentoring, feedback sessions, and regular check-ins can help teachers refine their gamification methods, adapt to technological challenges, and align these tools effectively with curriculum goals. These combined efforts will empower teachers to utilize gamified teaching elements more effectively, ultimately enhancing student engagement and learning outcomes in mathematics.

Future researchers are encouraged to pilot the proposed training program with a select group of mathematics teachers. Evaluation tools such as teacher feedback surveys, lesson implementation observations, and student engagement metrics should be employed to measure the impact on classroom practice and inform program refinement."

REFERENCES

1. Antonio, J. M. A., & Tamban, V. E. (2022). Effectiveness of gamification on learners' performance and attitude towards mathematics amidst the COVID-19 pandemic. *United International Journal for Research & Technology, 3*(3), 91–100. Retrieved from https://uijrt.com/articles/v3/i3/UIJRTV3I30013.pdf
2. Aronoff, S. (1989). *Geographic information systems: A management perspective*. Ottawa, Canada: WDL Publications.
3. Cabezas-González, M., & Casillas-Martín, S. (2024). Impact of gamification on motivation and academic performance: A systematic review. *Education Sciences, 14*(6), 639. https://doi.org/10.3390/educsci14060639
4. Hamari, J., Koivisto, J., & Sarsa, H. (2016). Does gamification work? A literature review of empirical studies on gamification. *International Journal of Human-Computer Studies, 97*, 162–178. https://doi.org/10.1016/j.ijhcs.2015.09.001
5. Kapp, K. M. (2012). *The gamification of learning and instruction: Game-based methods and strategies for training and education*. Pfeiffer.
6. Kiili, K., Ojansuu, K., Lindstedt, A., & Ninaus, M. (2018). Exploring the educational potential of a

game-based math competition. *International Journal of Game-Based Learning, 8*(2), 14–28. https://doi.org/10.4018/IJGBL.2018040102

7. Koul, O. (2009). *Methodology of educational research* (4th rev. & enlarged ed.). Vikas Publishing House Pvt Ltd.
8. Palinkas, L., Horwitz, S., Green, C., Wisdom, J., Duan, N., & Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed-method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research, 42*(5), 533–544. https://doi.org/10.1007/s10488-013-0528-y
9. Sitko, N. J. (2013). *Designing a qualitative research project: Conceptual framework and research questions*. Indaba Agricultural Policy Research Institute (IAPRI).
10. Vestige Academy. (2022, March 4). Define cooperative learning in education. Retrieved from https://vestigeacademy.com/2022/03/04/define-cooperative-learning-in-education
11. Zainuddin, Z., Chu, S., Shujahat, M., & Perera, C. J. (2020). The impact of gamification on learning and instruction: A systematic review of empirical evidence. *Educational Research Review, 30*, 100326. https://doi.org/10.1016/j.edurev.2020.100326