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Development and Evaluation of Math-Talino KNBA? Gamified Peer-Tutoring Program

Beverly R. Esteban, Allan Jay S. Cajandig

Sultan Kudarat State University, Philippines

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ABSTRACT

Gamification has emerged as an innovative approach, enhancing learner engagement in mathematics education. The development of Math-Talino KNBa? The Gamified Peer-Tutoring Program, introduces the overall instructional design and strategic teaching approaches of peer-tutoring on learning responses in Statistics and Probability. Developing this program using a Microsoft PowerPoint presentation is to help teachers deliver the strategic process with peer-tutoring throughout the discussion, applying the ADDIE model approach, which was the methodology used in the study. The participants are the 82 Grade 11 learners from Laguilayan National High School. Data were collected through a survey questionnaire and analyzed using descriptive statistics. Findings revealed the overall acceptability of the program from the experts and learners, particularly in fostering engagement through peer tutoring and gamification. Experts acknowledged the structured instructional design, highlighting its potential for scalability and adaptability in different learning environments. Moreover, the gamification elements, such as leaderboards and rewards, significantly enhanced participation and competition among learners. However, refinements in organizing mathematical concepts and balanced cognitive load were suggested to maximize learning outcomes. Some additional support mechanisms, such as teacher facilitation and adaptive difficulty levels, are needed to cater to diverse learning needs. It is recommended that future implementations enhance instructional scaffolding, provide continuous program evaluation, and explore the long-term impact of gamified peer tutoring on mathematical proficiency to optimize its effectiveness.

Keywords: Gamification, ADDIE, PowerPoint, Peer-Tutoring, Mathematics

INTRODUCTION

Mathematics education remains a major problem, however, with schools producing widely variable achievement in various aspects (according to multiple studies). Every three years, the Program for International Student Assessment, known as PISA, publishes data revealing variations in mathematical skills among students across the globe. According to the 2018 PISA data, approximately 22% of students in OECD countries do not achieve even the most basic levels of proficiency (OECD, 2019). Given this limitation, more innovative approaches are required to better facilitate background gaps of mathematical understanding and engagement (e.g. gamified tutoring).

One country trying to boost its global-competitiveness through better mathematics education is the Philippines, which has been making strides in enhancing its education system with programs targeting improvement in national and international test performance. But challenges remain for improving student's proficiency levels. Filipino students have consistently low performance in mathematics based on the National Achievement Test (NAT); more and more fail to reach the levels of competence needed in their pursuit of higher studies and employment (Department of Education, 2019).

These worries are corroborated by the 2023 National Education Performance Assessment (NEPA) results that show that under 40% of students demonstrated proficiency in numeracy skills. How much these results respond to actual punching is unknown.

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In Mindanao, these problems have been further pronounced given the socioeconomic status and the disparity in quality resources available in mathematics education. A study by Alonto et al. It[Gum, G. (2018)] revealed significant differences in literacy skills of students living in rural areas and emphasized the need for effective programs to improve basic skills of students living in isolated territories. The results reveal that combining gamified tutoring (e.g., games) in Mindanao classrooms to enhance motivation (Dulay et al., 2022). Socio-economic barriers are exacerbated by the geographical isolation of some parts of Mindanao. There are little incentives for these schools, and a lack of professional development opportunities prevents the maintainability of qualified teaching in Laguilayan National high school like with many of the rural municipals. Teachers are scarce, and students are not exposed to the latest developments in educational methodology — gamification, for example. In Mindanao, the Department of Education (DepEd) at the regional level observed that more than 30 percent of public schools experience teacher absenteeism and discontinuous lesson delivery, especially in remote areas. Consequently, students from these areas often find it difficult to excel in foundation subjects such as mathematics which may lead to stagnation in their academic pursuit, hence can impede their future opportunities.

Studies shows that Gamified Peer Tutoring programs would resolve these issues in a context-appropriate manner particularly in the Philippines, specifically Mindanao. For example, Rivera and Bernardo (2021) were able to show that over all engagement of the students were improved on the basis that ours would be the median region contrasted with the likes of Mindanao who were being extremely defunded, and that this method acted as a bridge to the funding disparity in gaming format. Certain students had a positive experience with gamified mathematical activities where they experienced self-efficacy, team work skills and motivation since games are fun, incorporating elements of competition and point-scoring with rewards.

The purpose of this study is to bridge the gaps that can improve the numeracy and problem-solving skills of learners based on gamified tutoring. In adding a local context, specifically Mindanao, Philippines, the study hopes to contribute to the growing body of literature on innovative pedagogical approaches. This study has implications for policy development, curriculum design, and teacher training programs relating to the improvement of mathematics education throughout the Philippines.

Statement of the Problem

This study aims to develop and evaluate the Math-talino KNBa? Gamified Peer-Tutoring Program using the Research and Development (R&D) approach, guided by the ADDIE instructional design model. Specifically, it seeks to answer the following questions:

What is the perceived level of students' performance in terms of:

Numeracy Skills; And

Problem-Solving Skills.

What are the identified needs for intervention to enhance numeracy and problem-solving skills, based on teachers’ perceptions of:

Interests;

Beliefs; And

Attitudes.

How is the Math-talino KNBa? Gamified Peer-Tutoring Program designed to address the identified needs and improve students' performance in mathematics?

What is the level of acceptability of the Math-talino KNBa? Gamified Peer-Tutoring Program among experts in terms of:

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Content Effectiveness;

User Engagement And Motivation;

Usability And Ease Of Implementation;

Gamification Elements (E.G., Points, Leaderboards, Rewards); And

Overall Instructional Design.

What is the level of acceptability of the Math-talino KNBa? Gamified Peer-Tutoring Program among students in terms of:

Content Effectiveness;

User Engagement And Motivation;

Usability And Ease Of Implementation;

Gamification Elements (E.G., Points, Leaderboards, Rewards); And

Overall Instructional Design.

METHODOLOGY

Research Design

In developing and testing the Math-talino KNBA? Gamified peer-tutoring program, this study will use a Research and Development (R&D) design. Gamified Peer-Tutoring. This differs from typical R&D processes in another field, where the goal is to design the rater processes, tools, and systems to develop, test, and implement new products or practices to improve the effectiveness of learning (Gustiani, 2019). A systematic approach that involves conducting needs analysis and designs and develops and implements and evaluates the success of the proposed model.

Respondents of the Study

The study was conducted at Laguilayan National High School during the School Year 2024–2025 and involved Grade 11 Senior High School students.

Research Instruments

To assess the experts and students level of acceptability, survey questionnaires was developed—using a 5-point Likert scale ranging from “Poorly Acceptable” to “Highly Acceptable.”

Data Collection and Analysis

The ADDIE model will be employed to obtain appropriate data for this study.

Analysis. Learners’ mathematics performance results in numeracy and problem-solving skills, based on assessment and evaluation done during Learning Action Cell (LAC) sessions, warrant a need for an intervention that will deepen learners’ understanding and interest in the subject matter. While there have been attempts to bring gamified strategies to prevent it, adding peer learning is pointed out as a strong contributor to overcoming the poor trend in mathematics results.

Design. The Math-talino KNBa? Gamified Peer-Tutoring aims to engage and support students challenged with numeracy and problem solving, specifically in the context of Statistics and Probability. Program mechanics

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will be created gamification-based (points, leaderboards, rewards). You are model through which the energy developing will including interactive peer-income approach that want help to achieve the learning outcome.

Development. The selected mechanics will be utilized to create the gamified peer-tutoring activities. Materials will be prepared around lesson goals, peer-to-peer interaction grounds, and game aspects.

Implementation. The program will be piloted in selected math classes. Participants will be aided and led through the gamification-based peer-tutoring actions, and facilitators will record engagement, participation, and performance improvement. Phase three will cross-section data based on learner progress and feedback.

Evaluation. The evaluation phase will enable us to determine the acceptability and usability of the Math-Talino KNBa? Gamified Peer-Tutoring Program according to R&D approaches. This process will involve:

Expert Review. The content, structure, and efficacy of the program in improving numeracy and problem-solving will be assessed by subject matter experts in mathematics education, instructional design, and gamification. The aim is to make it an agile, adaptive, learning system and feedback from teachers will help toward that goal.

Prototype Testing. A small group of learners will test the alpha version of the gamified peer-tutoring program to find any usability problems, level of engagement, and general implementation. Adjustments will be made as appropriate before full implementation, in response to observations and feedback.

Iterative Refinement. Improvements based on expert recommendations and prototype testing results will be implemented to further enhance the system's functionality, user experience, and educational impact.

Final Validation. The definitive version of the program will be thoroughly assessed so as to determine whether it achieves its aims and whether it is ready for more widespread dissemination in the mathematics learning contexts.

RESULTS AND DISCUSSION

This chapter presents the results, discussions, and analysis of the data gathered that sought to answer the study's objectives.

The results of the pretest quiz about numeracy skills consisting of 30 marks, and problem-solving skills that consisting of 40 marks are shared in Tables 2 and 3 below as part of the Analysis Phase in ADDIE (Analyze, Design, Development, Implement, and Evaluate) method. These results create a foundational understanding to work around the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model to investigate instructional gaps to improve both their numeracy skills and problem-solving mastery.

Table II Performance Distribution per Class in Numeracy Skills

Score Range	Class A (No. of Learners)	Class B (No. of Learners)	Total Learners
25 - 30	0	0	0
20 - 24	0	0	0
15 - 19	18	14	32
10 - 14	12	16	28
5 - 9	9	13	22
Overall Mean	**39**	**43**	**82**

Based on quiz scores, Table II describes the building performance distribution of learners in numeracy skills. The majority of learners (18 from class A and 14 from class B) scored in the 15-19 range (32 learners) and the

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10-14 range (28 learners), which indicate moderate mastery. Also, 22 learners attained scores in the 5–9 range, indicative of lower numeracy skills. Importantly, there were no learners with scores in the 20–30 range, which indicates a level at which students were unable to master the topics. A total of 82 learners were assessed, with mean scores of 39 and 43 for Class A and Class B, respectively.

The results on numeracy skills corroborate the existing literature which highlights the role of numeracy literacy quickly improving mathematical reasoning. Iswara et al. (2022) argue that without a strong foundation in numeracy, students struggle to engage effectively with mathematical concepts, which directly impacts their ability to solve complex problems. Kurniati et al. (2024) highlights that deficits in numeracy skills are linked to weaker critical thinking abilities, reinforcing the need for targeted instructional strategies. Garzon et al., (2021) suggest that using visual models in teaching mathematics can enhance students' numeracy skills by helping them conceptualize and apply mathematical principles more effectively.

Table III Performance Distribution per Class in Problem- Solving Skills

Score Range	Class A (No. of Learners)	Class B (No. of Learners)	Total Learners
41 — 50	0	0	0
31 — 40	0	0	0
21 — 30	0	0	0
11 - 20	23	26	49
0 - 10	16	17	33
Overall Mean	**39**	**43**	**82**

Table III shows the distribution of quiz scores of learners based on problem solving skills. The majority of learners (49 learners) scored in the range of 11–20 (Class A: n = 23; Class B: n = 26), while 33 learners scored in the range of 0–10, suggesting that many learners struggle in this area of programming problem solving. (Interpret this as no learner scored in the 21-50 range, meaning none performed at higher levels). The mean class scores for Class A and Class B were 39 and 43 respectively, for a total of 82 learners.

Their findings support research that calls for critical thinking to be taught as part of mathematics education. Louise et al. (2023) stress that problem-solving skills are cultivated through intentional pedagogical strategies that promote logical reasoning and analytical thought. Bautista et al. Language is critical in the domain of mathematics and problem solving | Cummings et al. Results hold implications for both pedagogy and promoting problem solving skills, emphasizing that specific strategies are effective only if linguistic and cognitive factors are accounted for in instruction, not just content material.

Table IV. Level of Teachers' Perceptions of Identified Needs for Intervention to Enhance Numeracy and Problem-Solving Skills in terms of Interests

	Statement	Mean	SD	Description
1.	My students become more interested in mathematics when peer tutoring is gamified.	4.47	0.57	Highly Acceptable
2.	Students become more engaged with mathematics when peer tutoring is gamified.	4.43	0.63	Highly Acceptable
3.	I feel more motivated to teach math when gamification is used in peer tutoring.	4.43	0.68	Highly Acceptable
4.	I have observed an increase in students' willingness to participate in math activities due to gamified peer tutoring.	4.33	0.61	Highly Acceptable
5.	I find that gamified peer-tutoring increases their interest in mathematics.	4.30	0.60	Highly Acceptable
Overall Mean		**4.39**	**0.61**	**Highly Acceptable**

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The perceptions of teachers each round for when intervention is needed for numeracy and problem-solving skills via interest-based learning strategies are in Table IV. Overall mean=4.39, standard deviation=0.61, suggesting that generally, respondents strongly agree on the need to consider the interests of their students in mathematics instruction. The indicator with the highest mean (4.47, SD = 0.57), indicating a need for gamified peer-tutoring plans based on interests and needs that would benefit students, was in complete line with a strong level of agreement among participants. Elements of energetic engagement-related instructional methods, such as activating teachers' motivation, aligning lessons with students' interests and hobbies and gamified peer-tutoring activities, all scored 4.43 on average, confirming a clear preference for both interesting and relevant methods of learning The only exception was for the lowest-rated indicator, which indicates the extent to which they find it worthwhile to learn mathematics, which had an average of 4.30, which also indicates strong agreement. The data therefore demonstrates the importance of gamified peer-tutoring, interactive and interest-driven learning strategies to promote individual engagement and improve mathematics learning.

The results are in line with Celemin (2023) and Indrawatiningsih et al. (2024), which highlights that making learning relevant to students' interests can support the development of more numerate and engaged young learners. This finding could be supported by the high level of agreement from the respondents on interest-based learning strategies, in particular personalized learning plans, suggests that differentiated instruction can play a positive role in enhancing students' understanding of mathematics. This trend towards real-world applications and interactive activities is in line with Gusteti et al. (2023), advocate for engaging and effective numerical literacy-based approaches as psychosocial interventions. Gamified PowerPoint presentations, while rating a bit lower, still falls under strong agreement indicating students appreciate interactive ways to learn though there may be more desirable immersive learning options. These results underscore the crucial need for customized instruction that resonates with students' interests, as it significantly enhances their engagement and skills in numeracy and problem-solving.

Table V. Level of Teachers' Perceptions of Identified Needs for Intervention to Enhance Numeracy and Problem-Solving Skills in terms of Beliefs

	Statement	Mean	SD	Description
1.	I observe that the student gains confidence in their ability to succeed in mathematics through gamified peer tutoring.	4.23	0.63	Highly Acceptable
2.	My student has developed more positive beliefs about their mathematical abilities through gamified peer tutoring.	4.47	0.63	Highly Acceptable
3.	Peer tutoring with a gamified approach encourages students to believe that they can improve their math skills.	4.33	0.71	Highly Acceptable
4.	I believe that gamified peer tutoring fosters a growth mindset in students.	4.43	0.63	Highly Acceptable
5.	Students are more confident in their mathematical abilities after participating in gamified peer tutoring.	4.23	0.63	Highly Acceptable
Overall Mean		**4.34**	**0.64**	**Highly Acceptable**

The first part of table V presents how teachers have perceived that belief of intervening is needed based on the results of the procedure on numeracy and problem-solving skills. The data shows an overall mean of 4.34 (SD = 0.64), which demonstrates that respondents agree with the effectiveness of gamified peer tutoring in changing their beliefs toward mathematics. The highest rated indicator means 4.47 ± 0.63; stating students are able to generate more positive beliefs about their mathematical abilities with gamified peer tutoring means highly acceptable. The lowest achieving indicators were that the students feel more confident in their ability to do mathematics through gamified peer tutoring, attaining a mean of 4.23, these attest to the positive perceptions of the students. Gamified peer tutoring through such activities taps into the qualities of confidence, aspiration, and self-efficacy, and these results suggest that it has potential as an educational

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intervention that could increase performance and further build students' belief that their mathematics can improve.

The results are fully consistent with Suliani et al. (2024), highlighting the interrelation between students' mathematical beliefs and their problem-solving approaches. The effectiveness of gamified peer tutoring on mathematical beliefs aligns with the concept that self-assurance enhances metacognition and problem-solving success (p. 551). Parental involvement in shaping students' numeracy beliefs (Balala et al. (2021) and Mahilum et al. In supporting this hypothesis (2023), the importance of establishing positive and constructive mathematical beliefs within students through the use of interactive, peer-driven and confidence-enhancing means, in order to facilitate and enhance students' numeracy and problem-solving skills.

Table VI. Level of Teachers' Perceptions of Identified Needs for Intervention to Enhance Numeracy and Problem-Solving Skills in terms of Attitudes

	Statement	Mean	SD	Description
1.	My students develop a positive attitude toward learning mathematics through gamified peer tutoring.	4.3	0.7	Highly Acceptable
2.	I have observed that students have a more positive attitude toward math after engaging in gamified peer tutoring.	4.37	0.61	Highly Acceptable
3.	My students show improved motivation and perseverance in math tasks after participating in gamified peer tutoring.	4.47	0.57	Highly Acceptable
4.	I believe that gamified peer tutoring helps improve students' attitude toward problem-solving in mathematics.	4.5	0.63	Highly Acceptable
5.	My students are more willing to collaborate with their peers in solving math problems when peer tutoring is gamified.	4.37	0.61	Highly Acceptable
Overall Mean		**4.4**	**0.62**	**Highly Acceptable**

Table VI presents a summary of attitudes towards the necessity for intervention (to improve numeracy and problem-solving skills) as perceived by teachers. With overall mean 4.4±0.62, it implies a positive influence of gamified peer tutoring on the attitude of students towards mathematics accepted by most of the respondents. By far the highest-rated statement, that they believe it helps improve their attitude towards problem solving with a mean of 4.5 and a standard deviation of 0.63. Evoking a positive attitude, having a mean of 4.37 and standard deviation of 0.61 respectively, willingness to work with their friend in solving math problems The lowest-rated indicators were students who had a positive attitude to learn mathematics because of gamified peer-tutoring (mean = 4.3; sd = 0.7). Yet, all indicators are highly accepted which indicates that gamified peer tutoring promotes motivation, involvement, and positive attitude towards mathematics.

These findings of increased numerical skills and a more positive attitude towards mathematics are consistent with the work of Dowker (2016) and Zerafa (2015) on the benefits of focused numeracy interventions (in this case, gamified peer tutoring). It also further supports the notion that intervening to change students' perspectives will lead to greater engagement and success with numeracy-focused tasks (Peters et al., 2017). Lee-Post (2019) recommends identifying students' learning bottlenecks to create effective interventions to foster numeracy skills and positive attitudes towards numeracy. Ni'mah et al. (2024) emphasize technology-

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integrated problem-based learning approaches that actively engage students and promote more positive attitudes toward mathematics, features that are core aspects of the effectiveness of gamified peer tutoring.

Table VII. Level of Acceptability of the Math-talino KNBa? Gamified Peer-Tutoring Program among Experts in Terms of Content Effectiveness

Statement	Mean	SD	Description
1. The Math-talino KNBa Gamified Peer-Tutoring Program is effective in enhancing mathematical problem-solving skills	4.07	0.57	Moderately Acceptable
2. The content of the Math-talino KNBa program aligns well with current educational standards	4.3	0.46	Highly Acceptable
3. The gamified elements in the Math-talino KNBa program increase student engagement with mathematical concepts	4	0.63	Moderately Acceptable
4. The peer-tutoring aspect of the Math-talino KNBa program is beneficial for students who struggle with math	4.4	0.49	Highly Acceptable
5. The Math-talino KNBa Gamified Peer-Tutoring Program provides comprehensive support for students' mathematical development	4.07	0.51	Moderately Acceptable
Overall Mean	**4.17**	**0.56**	**Moderately Acceptable**

Table VII shows the acceptability of the Math-talino KNBa Gamified Peer-Tutoring Program in relation to content effectiveness. A mean of 4.17 with a standard deviation of 0.56 suggest moderate acceptance among experts on the effectiveness of the program. As indicator with the highest mean (4.40) and lowest standard deviation (0.49), this indicates that the peer-tutoring aspect of the program is a significant benefit for struggling math learners. For other indicators such as improving students' skills in solving mathematical problems and providing holistic support for students' growth in mathematics, the mean is 4.07, which is moderately acceptable, respondents are very satisfied with the program. The indicator with lowest mean (4.00), SD (0.63) emphasizes on program's increase in students engagement with mathematical concepts.

Gamification increases the user engagement and the learning effectiveness, matching with models as GATUGU, that guarantee measurable educational output (Swacha et al., 2023). KW: Peer tutoring, an integral part of Math-talino KNBA, enhances cooperative learning approaches that aid understanding, retention, and levels of math anxiety (ODA et al., 2021). Aligning with standards voiced in education, relevance and preparedness are central themes in the mathematics instructional components of the program (Tashtoush et al., 2022). This is important, as reducing math anxiety and promoting success in math through interactive and

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supportive environments has been shown to improve learning while eliminating psychological and perceptual barriers (Supekar et al., 2015; Foley et al., 2017)

Table VIII. Level of Acceptability of the Math-talino KNBa? Gamified Peer-Tutoring Program among Experts in terms of User Engagement and Motivation

	Statement	Mean	SD	Description
1.	The Math-talino KNBa Gamified Peer-Tutoring Program effectively increases user engagement among students	4.6	0.49	Highly Acceptable
2.	The gamified elements of the Math-talino KNBa program motivate students to participate actively in their learning process	4.27	0.57	Highly Acceptable
3.	Students using the Math-talino KNBa Gamified Peer-Tutoring Program demonstrate higher levels of motivation compared to traditional learning methods	4.4	0.76	Highly Acceptable
4.	The competitive aspects of the Math-talino KNBa program foster a sense of achievement that enhances student motivation	4.2	0.65	Moderately Acceptable
5.	The interactive features of the Math-talino KNBA Gamified Peer-Tutoring Program encourage collaboration among students, further enhancing engagement	4.5	0.62	Highly Acceptable
Overall Mean		**4.39**	**0.64**	**Highly Acceptable**

Table VIII provides the evaluation of the experts on the Math-talino KNBa? Gamified Peer-Tutoring Program in terms of user engagement and motivation. With a mean of 4.39 and standard deviation of 0.64, all participants agreed that the program significantly increased student engagement and motivation. The highest mean rating (4.6) is given for the indicator, which suggests that all interactive features of the program can successfully motivate the students and keep them engaged. The program promotes group work between students which was rated high (with a score of 4.50 indicating expert satisfaction) as it leads to even more involvement and participation. Indicators related to program fostering a sense of achievement that enhances student motivation were rated slightly lower (M = 4.20) but still reflected agreement.

Gamification and peer tutoring have been an important methodology to increase student engagement and motivation in educational settings. Research has shown that organized peer questions helps students in need, promoting a nurturing environment and reducing educational inequalities while improving learning outcomes (Barahona et al., 2023; Abdulkarim et al., 2022; Ghalley et al., 2019; Pellegrini et al., 2021). Studies highlight that gamification improves the motivation and engagement of users, especially through the inclusion of interactive and competing features that increase the interaction of users (Tamrin et al., 2022; Acosta-Medina et al., 2021; Oluwajana et al., 2019; Zainol, 2022). Chapman et al. (2022) and Martins et al. (2023) have showed

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that gamified peer tutoring enhanced students' attitudes towards learning mathematics when learning became more rewarding and interactive. The impact of immediate feedback on establishing and maintaining positive behaviors additionally contributes to the success of using gamification in peer tutoring environments (Zeneli et al., 2016; Bernal et al., 2018).

Table IX. Level of Acceptability of the Math-talino KNBa? Gamified Peer-Tutoring Program among Experts in Terms of Usability and Ease of Implementation

	Statement	Mean	SD	Description
1.	The Math-talino KNBa Gamified Peer-Tutoring Program is user-friendly and easy to navigate for both tutors and students	4.07	0.44	Moderately Acceptable
2.	The program's technical requirements are straightforward and do not pose significant barriers to implementation	4.03	0.55	Moderately Acceptable
3.	The Math-talino KNBa program integrates well with existing educational platforms and systems	4.07	0.25	Moderately Acceptable
4.	The program provides adequate support and resources for educators to implement it effectively in their classrooms	4.5	0.5	Highly Acceptable
5.	The implementation process for the Math-talino KNBa Gamified Peer-Tutoring Program is streamlined and efficient, requiring minimal additional training for educators	4.17	0.37	Moderately Acceptable
Overall Mean		**4.17**	**0.47**	**Moderately Acceptable**

Table IX shows the experts' evaluation of Math-talino KNBa Gamified Peer-Tutoring Program based on usability and ease of implementation. Users showed a relatively high coherence with an overall mean of 4.17 and a standard deviation of 0.47, affirming its user-friendliness and seamless integration into educational settings. Education experts also agreed that the program offers enough support and resources for teachers to adequately apply the program to their classroom with a mean of 4.50. High usability is also attributed to the availability of both appropriate supports and resources for educators, as well as a well-managed implementation process needing as little extra training as possible. The results demonstrate the success of the program as a low-barrier, well-mentored, and easily-adopted resource for improving math learning via gamified peer tutoring.

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Other important factors determining whether peer tutoring programs get adopted are how easy they are to implement, and their ease of use. According to research on the cost-effectiveness of peer tutoring platforms compared to traditional instructional methods, peer tutoring platforms can be considered as a mean to invest in better engagement and/or performance of students in the long run (Barahona et al., 2023). In addition, effective programs usually need little extra training for both educators and tutors as previous studies have indicated that comprehensive training and clear definitions of roles lead to better learning outcomes and satisfaction (Batz et al., 2015). Technology makes it easier to use by providing engaging interfaces, tracking progress, and facilitating seamless implementation within existing educational platforms (Azlan et al., 2020; Alegre et al., 2020). These findings underscore the need for peer tutoring programs to be designed with accessibility, ease of use, and strong support in mind if they are to achieve the deepest learning impact.

Table X. Level of Acceptability of the Math-talino KNBa? Gamified Peer-Tutoring Program among Experts in Terms of Gamification Elements

Statement	Mean	SD	Description
1. The points system effectively motivates students to engage with the material.	4.03	0.18	Moderately Acceptable
2. The leaderboards foster a healthy sense of competition.	4.53	0.5	Highly Acceptable
3. The leaderboards encourage students to improve their performance.	4.47	0.5	Highly Acceptable
4. The gamification elements are appropriately integrated to enhance the overall learning experience.	4.1	0.3	Moderately Acceptable
5. The Math-talino KNBa Gamified Peer-Tutoring effectively utilizes gamification to create a more motivating learning environment.	4.03	0.18	Moderately Acceptable
Overall Mean	**4.23**	**0.42**	**Highly Acceptable**

Table X of the Acceptability of the Math-talino KNBa Gamified Peer-Tutoring Program when it comes to gamification elements among expertise With a mean of 4.23 (SD: 0.42) it shows a high acceptance on the effectiveness of program's gamified features. The highest mean of 4.53 (SD = 0.43) corresponded to leaderboards that promote a sense of competition. Points Effectively Motivates Students in Engaging with Material and the Program uses Gamification which Creates A More Motivating Learning Environment having a mean of 4.03 and a standard deviation of 0.18 Results thus show that expert views are highly positively oriented towards the effect of gamification on learners' motivation and engagement.

Points, badges and leaderboards have been an effective part of gamification widely used to increase learner engagement and motivation of the learners (León et al., 2022; León et al., 2021) These elements create a competitive yet collaborative learning atmosphere, which is in line with the emphasis on motivation and engagement of the Math-talino KNBa Gamified Peer-Tutoring Program. Indeed, leaderboards have been singled out as a primary driver of competition and engagement, corroborating their ongoing role as a motivator for student activity. Studies have described that for learners to engage with gamified educational platforms, it is crucial that the elements of gamification are seen as usable and relevant to the subject matter being taught (Denden et al., 2022; Oluwajana et al., 2019). Together, these elements create enticing environments for learning, in which educational materials stimulate enjoyable interaction (Toda et al, 2019;

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Alsawaier 2018). These results highlight the significance of thoughtful implementation of gamification techniques in promoting students' motivation and academic involvement.

Table XI. Level of Acceptability of the Math-talino KNBa? Gamified Peer-Tutoring Program among Experts in Terms of Overall Instructional Design

	Statement	Mean	SD	Description
1.	The instructional design effectively supports diverse learning styles.	4.5	0.5	Highly Acceptable
2.	The learning objectives are aligned with the activities and assessments.	4.03	0.18	Moderately Acceptable
3.	The Math-talino KNBa Gamified Peer-Tutoring integrates gamification elements in a way that enhances, rather than distracts from the instructional goals.	4.07	0.25	Moderately Acceptable
4.	The peer-tutoring component of the Math-talino KNBa is engaging.	4.5	0.5	Highly Acceptable
5.	The Math-talino KNBa Gamified Peer Tutoring provides a balanced learning experience.	4.43	0.5	Highly Acceptable
Overall Mean		**4.31**	**0.46**	**Highly Acceptable**

Table XI accepts the instruction design of Math-talino KNBa Gamified Peer-Tutoring Program by the experts On the 4.31 with a standard deviations of 0.46 as whole mean score itself shows the most acceptable on the instructional of the program. The program's instructional design that provides substantial assistance to various learning styles and the peer-tutoring part of the Math-talino KNBa, yielded the highest mean of 4.50 and a standard deviation of 0.50 each. The alignment of activities and assessment had the lowest mean value (4.03) and standard deviation (0.18). The results suggest that experts were highly satisfied with the program as it was designed, albeit with slight differences in their perceptions in terms of activity alignment and learning assessment.

The way gamified learning environments are designed for instruction is of utmost importance for learners to engage and acquire knowledge. Studies show that gamification can be an excellent way to support varied learning styles and improve engagement through thoughtfully designed teaching strategies (Tsay et al., 2018; Swacha & Szydłowska, 2023). Math-talino KNBa Gamified Peer-Tutoring Program AssessmentBased on the principle of COSS, a structured peer-tutoring experiment in the form of the Math-talino KNBa Gamified Peer-Tutoring Program aligns well since the framework allows deeper instructional designs enriches instructional goals while preserving a well-balanced approach in terms of instruction, a practice, and an assessment (Oliveira et al., 2022). Such frameworks, studies revealed, were beneficial for students learning in that it provided additional opportunity for students to connect to the subject, themselves and others (Batz et al., 2015). Including these elements in the design of this and similar gamified peer tutoring programs is crucial to its effectiveness and longevity in maintaining student motivation.

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Table XII. Level of Acceptability of the Math-talino KNBa? Gamified Peer-Tutoring Program among Students in Terms of Content Effectiveness

	Statement	Mean	SD	Description
1.	The Math-talino KNBa Gamified Peer-Tutoring helps me understand mathematical concepts more clearly.	4.43	0.50	Highly Acceptable
2.	The content of the Math-talino KNBa is relevant to my everyday life.	4.42	0.49	Highly Acceptable
3.	The Math-talino KNBa effectively addresses my difficulties in specific areas of mathematics.	4.19	0.39	Moderately Acceptable
4.	The peer-tutoring aspect of the Math-talino KNBa helps me learn from my peers in a supportive environment.	4.75	0.43	Highly Acceptable
5.	The Math-talino KNBa Gamified Peer-Tutoring provides coverage of the mathematical topics I need to learn.	4.61	0.49	Highly Acceptable
Overall Mean		**4.48**	**0.46**	**Highly Acceptable**

In terms of content effectiveness, the level of acceptability of the Math-talino KNBa Gamified Peer-Tutoring Program among students is shown in Table XII. The general referent mean 4.48 with a standard deviation 0.46 confirmed highly accepted on the program effectiveness in providing mathematical contents. The peer-tutoring aspect is the highest mean (4.75, sd=0.43) which the supportive learning in a collaborative context. The mean did not exceed 4.19 in the concern (despite) specific mathematical difficulties (SD=0.39). The students appear to consider the programme effective in improving their understanding of mathematical concepts, especially with peer interaction, while being less certain about its effectiveness in targeting their individual difficulties.

Research provides strong evidence for content delivery in peer-tutoring programs, as it promotes the development of deeper knowledge through collaborative learning (Burgess et al., 2016). The students also noted that it has made their understanding and retention of the concepts much better, especially when they have to deal with their peers, which is the framework behind the Math-talino KNBA Gamified Peer-Tutoring Program. Although there are slight variations around the wording that indicates specific mathematical difficulties, this implies that more differentiated instruction strategies need to be deployed as a prevention or intervention measure to avoid the omission of done described earlier and allow for a better adaptation to diverse learning needs (Johnson et al., 2019).

Table XIII.Level of Acceptability of the Math-talino KNBa? Gamified Peer-Tutoring Program among Students in terms of User Engagement and Motivation

	Statement	Mean	SD	Description
1.	The Math-talino KNBa Gamified Peer-Tutoring keeps me engaged in learning mathematics.	4.47	0.50	Highly Acceptable
2.	The gamified elements motivate me to participate actively in my math learning.	4.48	0.50	Highly Acceptable
3.	I feel more motivated to learn math when using the Math-talino KNBa gamified learning activities.	4.66	0.47	Highly Acceptable
4.	The peer-tutoring aspect of the Math-talino KNBa helps me stay motivated by working with my peers.	4.47	0.50	Highly Acceptable
5.	The Math-talino KNBa Gamified Peer-Tutoring makes learning math enjoyable.	4.48	0.50	Highly Acceptable
Overall Mean		**4.51**	**0.49**	**Highly Acceptable**

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The level of acceptability of Math-talino KNBa Gamified Peer-Tutoring Program in terms of user engagement and motivation among the students is shown in Table XIII. A mean of 4.51 and a standard deviation of 0.49 were computed which indicates highly acceptable on the program's effectiveness. In keeping students engaged and motivated in learning mathematics. With a mean of 4.66 and a standard deviation of 0.47, the statement regarding students feeling more motivated to learn math through the program than other traditional teaching methods received the highest mean. The lowest mean of 4.47 (standard deviation: 0.50) was observed in the program's ability to keep students engaged and in the peer-tutoring aspect's role in maintaining motivation. These findings indicate that students perceive the program as very enjoyable and motivating, especially relative to traditional instructional methods.

In shaped gamification effects towards driving user engagement and motivation, the Math-talino KNBa Gamified Peer-Tutoring Program showcased high effectiveness that aligns with literature on the subject matter and highlights how gamification as a pedagogical tool can be transformative in market to recent students. The program's talent for keeping students interested is consistent with research that indicates the use of gamification has a positive impact on cognitive, affective, and behavioral engagement (Dehghanzadeh et al., 2023). The addition of game elements (e.g. rewards and feedback) as one of the most important and motivating factors in games has a proven effect on intrinsic motivation that enables players to keep participating in learning activities (Karabıyık, 2024; Noperta et al., 2023). The Math-talino KNBA program cleverly embeds peer tutoring into a gamification framework which further sustains engagement through structured interactions that supports previous literature's findings that high levels of structured engagement tended to strongly increase motivational outcomes (Duggal et al., 2021).

Table XIV. Level of Acceptability of the Math-talino KNBa? Gamified Peer-Tutoring Program among Students in terms of Usability and Ease of Implementation

	Statement	Mean	SD	Description
1.	The Math-talino KNBa Gamified Peer-Tutoring is easy to use and navigate for students.	4.68	0.47	Highly Acceptable
2.	I found it straightforward to understand how to participate in the Math-talino knba gamified.	4.32	0.47	Highly Acceptable
3.	The technical requirements for accessing the Math-talino KNBa are manageable and do not hinder my learning experience.	4.41	0.49	Highly Acceptable
4.	The implementation of the Math-talino KNBa Gamified Peer-Tutoring in my classroom was seamless and efficient.	4.70	0.46	Highly Acceptable
5.	The resources used in the Math-talino KNBa are adequate for enhancing my learning experience.	4.70	0.46	Highly Acceptable
Overall Mean		**4.56**	**0.47**	**Highly Acceptable**

Table XIV shows the acceptability level of Math-talino KNBa Gamified Peer-Tutoring Program among students based on usability and ease of implementation. The general mean which is 4.56 with a standard deviation of 0.47 means strongly agree on the program ease of use, and smooth implementation. A mean of 4.70 (standard deviation=0.46) was the highest for both the seamless use of the program in the classroom and the adequacy of resources and support. The lowest mean was (4.32) found in response to the statement regarding ease of understanding the participation in the absence of extensive training with standard deviation equal to 0.47. This indicates that students find the program to be user-friendly and well-supported; a strong combination that can lead to an efficient learning process.

The Math-talino KNBa Gamified Peer-Tutoring Program has shown high usability and ease of implementation based on research on gamified learning systems. Usability is of great importance in any educational

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technology, and the presence of interactive design in educational technology is observed to influence engagement with said technology as well (Legaki et al., 2020; Rincón-Flores et al., 2022). Sustained adoption in schools is largely contingent on the ease of implementation, before the sustainment of well-planned gamified systems can take place, resources, and training is required to replace a legacy system (Al-Bataineh et al., 2018; Wang et al., 2024). However, in the initial stages, set-up and training difficulties may surround the program, extended support and clear program implementation plans influence the long-term feasibility and effectiveness of such programs (Alshammari, 2020; Almuntsr et al., 2024). Findings confirm simplicity for users and seamless adaptation to the environment.

Table XV. Level of Acceptability of the Math-talino KNBa? Gamified Peer-Tutoring Program among Students in terms of Gamification Elements

	Statement	Mean	SD	Description
1.	The points system in the Math-talino KNBa effectively motivates me to complete math exercises and activities.	4.46	0.50	Highly Acceptable
2.	The leaderboards in the Math-talino KNBa create a healthy sense of competition that encourages me to improve my math skills.	4.67	0.47	Highly Acceptable
3.	The rewards system in the Math-talino KNBa provides a sense of accomplishment when I achieve learning milestones.	4.48	0.50	Highly Acceptable
4.	The gamification elements make learning math more enjoyable and engaging.	4.56	0.50	Highly Acceptable
5.	The use of gamification elements in the Math-talino KNBa helps me stay motivated.	4.53	0.50	Highly Acceptable
Overall Mean		**4.54**	**0.49**	**Highly Acceptable**

Students' level of acceptability on the Math-talino KNBa Gamified Peer-Tutoring Program as shown on table XV is in the aspect of gamification elements. Gamification has the potential to increase motivation and engagement with an overall mean of 4.54 and standard deviation of 0.49 that indicates highly acceptable. The highest mean score of 4.67 (SD = 0.47) was obtained for the statement that leaderboards create a healthy sense of competition. The mean lowest mean was 4.46 and found in the statement "The points system helps motivate students to complete exercises", and the standard deviation was 0.50. Overall, these findings indicate that the students found the gamification components of the program, especially the competitive component, to be valuable contributors to their learning experience.

The Math-talino KNBa Gamified Peer-Tutoring Program [2019-2020] (ERRATUM) – This program successfully increases student motivation and engagement, keeping them connected and entertained throughout the process, while still learning vital skills through competitive healthy elements like leaderboards, rewarding students with tangible prizes, and incorporating casual competition. Sailer eta al.,(2019) demonstrated in their research that such elements positively affect cognitive, motivational, and behavioral learning outcomes as well as Dindar et al. (2020) underline how gamified collaboration can have a beneficial effect on social activities and engagement. Solekhah et al. (2023) mention that the impact of gamification varies, calling for a balanced approach in implementation. Overall, challenge-based, gamified components, such as point systems and regimented activities, can help students be more academically motivated, and perform better at academic tasks (Kaya et al., 2023).

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Table XVI.Level of Acceptability of the Math-talino KNBa? Gamified Peer-Tutoring Program among Students in terms of Overall Instructional Design

	Statement	Mean	SD	Description
1.	I find that the Math-talino KNBa instructional design aligns well with my learning style and needs.	4.42	0.49	Highly Acceptable
2.	I find the learning objectives of the Math-talino KNBa clear and achievable, helping me understand what I need to learn.	4.49	0.50	Highly Acceptable
3.	I find that the Math-talino KNBa effectively integrates peer tutoring and gamification elements to enhance my learning experience.	4.59	0.49	Highly Acceptable
4.	The instructional materials and activities in the Math-talino KNBa are well-organized and easy to follow.	4.48	0.50	Highly Acceptable
5.	The Math-talino KNBa provides a comprehensive and structured approach to learning mathematics, which helps me stay on track with my studies.	4.33	0.47	Highly Acceptable
Overall Mean		**4.46**	**0.49**	**Highly Acceptable**

Table XVI depicts the level of acceptability of Math-talino KNBa Gamified Peer-Tutoring Program among students with regard to general instructional design of the program. The Overall mean of 4.46 with a SD of 0.49 shows a highly acceptable on the effectiveness of the instructional design in support student learning. The highest mean of 4.59 (SD, 0.49) was for the task of effective integration of peer tutoring and gamification elements. The statement regarding a structured approach to learning mathematics got the lowest mean (4.33) with a standard deviation of 0.47. These findings shed light on the program's success in mixing gamification, while ensuring readability and instructional design, but also provide insight on how the learning process could be structured better.

This is a well/good instructional design on a Math-talino KNBa Gamified Peer-Tutoring Program which is integrating the Peer Tutoring and Gamification for their students to learn. Instructional dynamics remain important to keeping students engaged and motivated in a gamified setting (Rueckert et al., 2023; Qiao et al., 2022). Chen et al's finding is well-supported by the program's strong alignment of instructional strategies with gamification principles so that students learn through carefully structured learning experiences. (2023) and along with them support their call for scaffolding and phase-based approach to instruction. The program is reinforced with cooperative and competitive learning, where individual and collaborative learning interact within the instructional framework (Mohamed, 2024). Studies such as Waluyo et al. Refer to the underlying process through which gamification boosts engagement as their temporal dynamical model of gamification and identify a risk that gamification may lead to an unstructured approach of entropic engagement without cognitive depth; more should be done to keep the goals of the game elements aligning with the learning objectives (2023). These findings support that the Math-talino KNBA program developed an effective instructional design that promotes gamification in an educationally relevant manner but still involved an extensive gap in refining the structure of the learning process.

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Table XVII.Overall rating for the Level of Acceptability of the Math-talino KNBa? Gamified Peer-Tutoring Program among Experts

Statement	Mean	SD	Description
1. Content Effectiveness	4.17	0.56	Moderately Acceptable
2. User Engagement and motivation	4.39	0.64	Highly Acceptable
3. Usability and ease of implementation	4.17	0.47	Moderately Acceptable
4. Gamification elements	4.23	0.42	Highly Acceptable
5. Overall instructional goal	4.31	0.46	Highly Acceptable
Overall Mean	**4.25**	**0.52**	**Highly Acceptable**

The overall rating of responses on the acceptability of the Math-talino KNBA Gamified Peer-Tutoring Program among experts is shown in table XVII. The total mean is 4.25 and standard deviation 0.52, descriptive rating of Highly Acceptable. The highest mean was observed in user engagement and motivation (4.39 ± 0.64; strongly agree), among the indicators. These metrics demonstrate the success of the program in keeping learners engaged. Content effectiveness and usability and ease of implementation have the lowest mean of this category 4.17 (s.d. 0.56) and 4.17 (s.d. 0.47) respectively and fall under Moderately Acceptable. Even those lowest-rated aspects still indicate a generally positive reception from experts. Such findings demonstrate how well the program cultivates learner interaction and meets instructional objectives, albeit with usability improvements and content structures that can magnify their effects.

Part of this phenomenon supports the notion that near-peer tutors may be perceived as or more acceptable than faculty tutors in terms of shared experiences and dynamics, which benefits the learning experience (Morgan et al., 2017; Sand-Jecklin et al., 2019). The high ratings assigned to components related to game mechanics is consistent with studies that have indicated that the inclusion of challenges and rewards increases the motivation and willingness of students to engage with learning activities (Yan et al., 2022; Tamrin et al., 2022; Oluwajana et al., 2019).

Content effectiveness and usability received comparatively lower ratings, but they still received positive scores, suggesting that the instructional design of the program is solid but may require some adjustments in the organization of content. This corroborates literature emphasizing that perceived usefulness and perceived ease of use considers to be the strongest contributing factors driving effectiveness of gamified educational programs, supported by the Technology Acceptance Model (Tamrin et al., 2022; Vanduhe et al., 2020; Nadlifatin et al., 2021). This positive expert appraisal indicates that the Math-talino KNBA Gamified Peer-Tutoring Program effectively combines gamification and peer tutoring techniques, offering an interactive and structured modality for learning mathematics.

Although content effectiveness and usability received relatively lower ratings, they were still positively evaluated, indicating that the program's instructional design is generally well-received but may benefit from refinements in content organization. These findings align with studies emphasizing that the effectiveness of gamified educational programs is strongly influenced by perceived usefulness and ease of use, as highlighted in the Technology Acceptance Model (Tamrin et al., 2022; Vanduhe et al., 2020; Nadlifatin et al., 2021). The positive expert evaluation suggests that the Math-talino KNBA Gamified Peer-Tutoring Program successfully integrates gamification and peer tutoring strategies, creating an engaging and structured approach to mathematics education.

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Table XVIII. The overall rating for the Level of Acceptability of the Math-talino KNBa? Gamified Peer-Tutoring Program among Students

Statement	Mean	SD	Description
1. Content Effectiveness	4.48	0.50	Highly Acceptable
2. User Engagement and motivation	4.51	0.50	Highly Acceptable
3. Usability and ease of implementation	4.56	0.50	Highly Acceptable
4. Gamification elements	4.54	0.50	Highly Acceptable
5. Overall instructional goal	4.46	0.50	Highly Acceptable
Overall Mean	**4.51**	**0.50**	**Highly Acceptable**

Table XVIII shows the general rating of the level of acceptability of Math-talino KNBA Gamified Peer-Tutoring Program among the students. The overall mean 4.51 (SD = 0.50) was considered highly acceptable. The highest mean was recorded for usability and ease of implementation, with mean of 4.56 and standard deviation of 0.50, thus indicating that the students believed that the program was easy to use and implement. Table 1 indicates that the overall instructional goal had the lowest mean (4.46) and standard deviation (0.50), but was still rated as strongly agree. Overall, these findings indicate that this program is viewed by students as engaging, very usable, and likely to help them learn, but with areas that can be improved further so as to be fully aligned with its instructional goals.

This means that students widely accepted gamification elements, which research also indicates were a feature of learning environments that increase motivation and satisfaction (Alshammari, 2020; Suwandani et al., 2024). The high usability rating of the Math-talino KNBa? Gamified Peer-Tutoring Program is aligned with studies indicating that effective gamification designs enhanced student engagement and promote an exciting learning environment for students (Romero-Rodríguez et al., 2019; Sailer et al., 2019).

Importantly, this discovery reinforces what previous studies highlight as the potential for peer tutoring to enhance mathematical achievement, as the relational and collaborative aspects underscore its effectiveness across all educational levels (Sand-Jecklin et al., 2019; Pellegrini et al., 2021). The high acceptability of the program for students demonstrates that gamification and peer tutoring can successfully nurture cognitive and emotional engagement (Biryukov et al., 2021; Toda et al., 2019), confirming previous findings regarding the impact of the approaches on students' psychological and educational needs.

There were some areas for improvement where over-all impact could be improved at the next iteration of this program, especially regarding content alignment and pedagogical strategies as the lowest rated instructional goal still achieved a strong level of agreement in its applicability. This consistency with earlier research highlights the need for constant enhancement of gamified education sessions to elevate learning interest and academic success.

CONCLUSIONS

Based on the findings of this study, the following are concluded:

From the quiz results, students demonstrated struggle in numeracy and problem-solving skills. Challenges were identified in applying mathematical concepts to complex problem-solving situations, highlighting a need for targeted interventions.

Based on teachers' perceptions, factors such as interests, beliefs, and attitudes played a crucial role in the students' engagement with mathematics. Students expressed a preference for interactive and collaborative

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learning experiences, emphasizing the need for an instructional approach that fosters positive attitudes and sustained motivation in learning mathematics.

The program was developed to address these learning gaps by integrating peer tutoring with gamification strategies. The design incorporated structured scaffolding, interactive problem-solving activities, and competitive game elements to enhance student motivation, engagement, and overall mathematics performance.

Experts found the Math-talino KNBa gamified peer-tutoring program highly acceptable, particularly in terms of user engagement and motivation, gamification elements and the overall instructional design. The program was recognized for its structured approach and engaging gamified activities that foster peer-tutoring, though suggestions for refining certain aspects on the content, usability and implementation were noted.

Students responded positively to the program, emphasizing its effectiveness in making mathematics more engaging and accessible. The integration of gamification elements such as points, leaderboards, and rewards significantly enhanced motivation and participation. While the overall instructional design was well-received, refinements in content organization and reinforcement strategies were recommended to further enhance learning outcomes.

RECOMMENDATION

Based on the findings and conclusion of this study, the following are recommended:

1. Teachers may implement contextualized problem-solving activities, regular assessments, and differentiated instruction to enhance students' numeracy and problem-solving skills.
2. Engaging, student-centered strategies such as gamification and peer mentoring should be integrated to foster positive attitudes, beliefs, and interests in mathematics.
3. The Math-talino KNBA Gamified Peer-Tutoring Program should be refined through further testing, adaptive learning pathways, and alignment with curricular standards.
4. Teacher training and continuous feedback should be prioritized to improve the program’s usability, engagement, and effectiveness in diverse learning environments.
5. Future research should enhance instructional scaffolding, provide continuous program evaluation, and explore long-term impact of gamified peer-tutoring on mathematical proficiency to optimize its effectiveness.

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