

Malaysia Journal of Invention and Innovation

<https://journal.academicapress.org/aps/index.php/mjii>

Research Article

XTif GMath: A Gamified, Interactive, AI-Generated Application for Learning Form 1 KSSM Mathematics

Syahrul Affendi Abdul Rahman^{1,*}

¹ Maktab Rendah Sains MARA Kuala Klawang; syahrul.affendi@mara.gov.my

* Correspondence: syahrul.affendi@mara.gov.my; +606-6112561.

Keywords:

Gamification
Mathematics Education
Interactive Learning
Artificial Intelligence
KSSM Form 1

Abstract:

XTif GMath is a gamified, interactive and AI-generated learning application designed using Google AI Studio to support Form 1 KSSM Mathematics. This study examined students' perceptions after a structured 45-minute usage session followed by a survey of 104 respondents. Descriptive findings revealed high mean scores for interactivity ($M = 4.367$), gamification ($M = 4.282$), Mathematics self-efficacy ($M = 4.212$), and usability ($M = 4.464$) with strong reliability scores ($\alpha = 0.701-0.912$). Thematic analysis of open-ended responses indicated that students appreciated the interactivity, visuals, gamified rewards, and clarity of explanations, while challenges included difficult questions, confusing wording, unclear hints, and minor technical bugs. Students suggested improvements such as enhanced visuals, better feedback, additional levels, and more features. The study demonstrates strong potential for large-scale adoption of gamified, interactive and AI-generated Mathematics applications in Malaysian schools.



Copyright: © 2026 by the authors. Submitted for open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. INTRODUCTION

The integration of digital technology into education has become increasingly important in Malaysia, particularly with the introduction of the Digital Education Policy (DEP) 2023–2030. This policy encourages the use of Artificial Intelligence (AI), interactive digital tools, and innovative teaching approaches to strengthen digital competence among teachers and students. In Mathematics education, digital tools are believed to enhance conceptual understanding, increase student motivation, and support differentiated learning.

Despite many available applications for Mathematics learning, most are developed commercially or internationally. Very few are aligned directly with the Malaysian KSSM curriculum, and almost none are developed using AI-generated content by local teachers themselves. This represents a major gap: while AI tools are increasingly available, educators may not yet understand their potential for creating interactive, gamified, and curriculum-aligned content without programming expertise.

XTif GMath was developed using Google AI Studio to explore this potential. The app integrates animations, sliders, drag-and-drop interactions, quizzes, hints, and gamified challenge modes to support the 13 Form 1 Mathematics topics. This study aims to evaluate students' perceptions of XTif GMath focusing on the constructs of interactivity, gamification, Mathematics self-efficacy, and usability. Understanding student perceptions is essential, as successful implementation of digital learning tools depends not only on technological functionality but also on user acceptance.

2. LITERATURE REVIEW

2.1 Gamification in Mathematics Learning

Gamification applies game elements such as points, rewards, levels, challenges, and feedback into non-game contexts. Past studies (Hamari et al., 2014; Mansor & Rosly, 2024) show that gamification increases students' motivation, persistence, and enjoyment in learning. In Mathematics specifically, gamified environments encourage repeated practice, reduce anxiety, and help students approach problem-solving more confidently.

2.2 Interactivity and Digital Engagement

Interactivity is central to effective e-learning. Clark and Mayer (2016) highlight that interactive elements such as drag-and-drop activities, sliders, and animated representations improve cognitive processing by helping students manipulate and visualize abstract mathematical concepts. Malaysian research also shows that interactive mobile applications increase student engagement and understanding (Zulkifli & Baharuddin, 2022).

2.3 Mathematics Self-Efficacy

Bandura (1977) defines self-efficacy as the belief in one's ability to succeed in specific tasks. In Mathematics, self-efficacy relates closely to achievement, motivation, and learning behaviour. Students with higher Mathematics self-efficacy generally perform better, show more persistence, and experience less anxiety. Digital tools that provide scaffolding, immediate feedback, and supportive learning environments have been proven to enhance self-efficacy (Julaihi et al., 2022).

2.4 Usability in Digital Applications

Usability refers to ease of use, clarity, navigation, and user-friendliness. Nielsen (1993) emphasises that poorly designed interfaces reduce engagement, even when educational content is strong. Usability is especially important for young learners who may struggle with complex layouts or unclear instructions. A highly usable interface supports smooth interactions and encourages exploration, which is critical for gamified learning tools.

2.5 AI-Generated Applications in Education

AI tools such as Google AI Studio create new possibilities for teachers to develop educational applications without programming skills. This reflects the emerging notion of the teacher as developer, where educators take an active role in designing, customising, and refining AI-generated interactive and gamified content that aligns with the national curriculum. However, research on the effectiveness of AI-generated learning applications, particularly in Malaysia, remains limited. Early reflections highlight several challenges, such as AI's difficulty in generating accurate mathematical visuals (e.g., angles and diagrams) and the need for iterative refinement. This study contributes new insights into this evolving field.

3. METHODOLOGY

3.1 Research Design

This study employed a quantitative descriptive design supported by qualitative thematic analysis. The goal was to evaluate students' perceptions of XTif GMath in terms of key constructs rather than measure direct learning outcomes.

3.2 Participants

A total of 104 Form 1 students from MRSM Kuala Klawang participated. Respondents represented mixed ICT proficiency levels and varying exposure to learning applications, allowing diverse feedback.

3.3 Research Instrument

1. A structured questionnaire was used, consisting of:
2. 25 Likert-scale items measuring interactivity, gamification, Mathematics self-efficacy, and usability
3. 3 open-ended questions on likes, challenges, and improvement suggestions

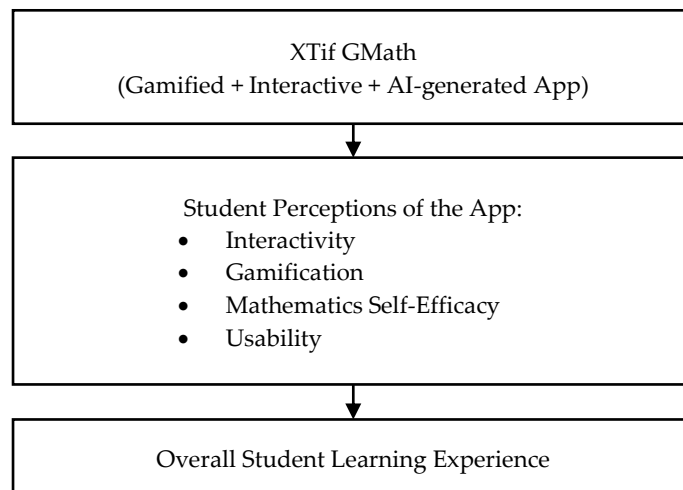


Figure 1. Conceptual Framework of the Study

Cronbach alpha values ranged from 0.701 to 0.912, demonstrating strong reliability.

Table 2. Reliability Results

Construct	Number of Items	Cronbach's Alpha (α)	Interpretation
Interactivity	6	0.701	Acceptable
Gamification	9	0.836	Very Good
Self-Efficacy	6	0.912	Excellent
Usability	4	0.734	Good

3.4 Procedure

Students underwent:

1. Briefing session (5 minutes)
2. 45-minute XTif GMath exploration using desktops
3. 15-minute survey completion via Google Form

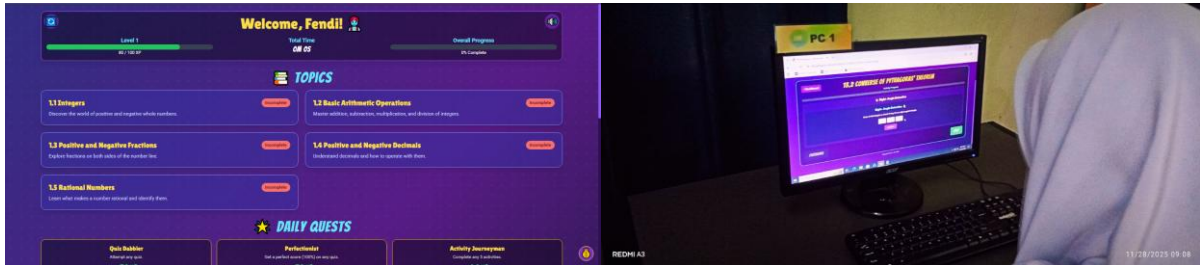


Figure 2. XTif GMath app interface (left) and student playing XTif GMath on computer (right).

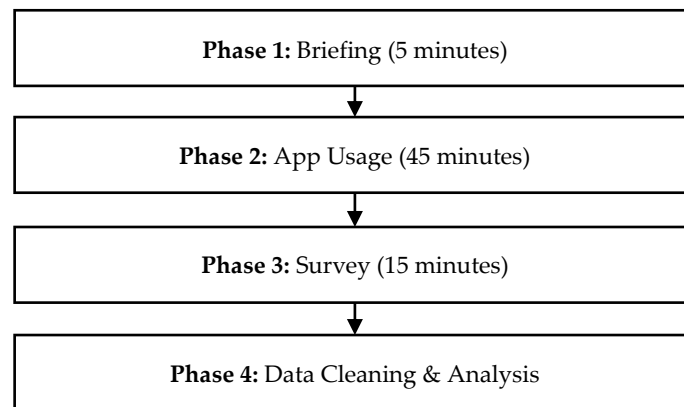


Figure 3. Research Procedure Flowchart

3.5 Data Analysis

Quantitative data were analysed using descriptive statistics. Qualitative responses (F1–F3) were analysed using Braun and Clarke’s thematic analysis method, producing student-driven themes aligned with their experiences.

3.6 Developer Reflection Integration

As XTif GMath was AI-generated, reflections on development challenges were included. These findings triangulate student feedback, strengthening the interpretation of results.

4. FINDINGS

4.1 Quantitative Results

All constructs showed high mean scores:

Table 1. Descriptive Statistics for Constructs

Construct	Mean (M)	Standard Deviation (SD)	Interpretation
Interactivity	4.367	0.836	High
Gamification	4.282	0.918	High
Self-Efficacy	4.212	0.940	High
Usability	4.464	0.844	Very High

These results confirm that students strongly accepted XTif GMath.

4.2 Qualitative Findings

F1 – What students liked:

- Interactive elements (slider, drag-and-drop, animations)
- Colourful visuals and smooth transitions
- Gamified components (badges, XP points, retries)
- Quizzes with instant feedback
- Music/sound effects

F2 – Challenges faced:

- Some questions felt too difficult
- Hints not always helpful
- Visual diagrams occasionally unclear
- Minor bugs (Repeated XP increment when clicking the “Check Answer” button)

F3 – Suggested improvements:

- Clearer step-by-step hints
- More visuals for complex topics
- Additional challenge modes
- Better user interface (UI)/user experience (UX)

4.3 Triangulation with Developer Reflections

Student challenges align with developer experience when develop the application using Google AI Studio:

- AI struggles generating accurate visuals for geometry/angles/diagram
- AI instructions need one-step-at-a-time prompts
- Multi-step prompts sometimes overwrite correct existing content

This strengthens the validity of findings.

5. DISCUSSION

The results of this study suggest that an AI-generated application such as XTif GMath can support students in engaging with Mathematics in a more enjoyable and meaningful way. The usability scores point to an important observation whereby most students were able to move around the app comfortably and understood its layout without much difficulty. The gamified features evidently played a role in keeping students motivated, a trend that reported by both Malaysian and international studies. Student feedback mirrored developer reflections, revealing persistent issues in diagram accuracy, hint clarity, and interface alignment, highlighting the importance of human-guided refinement when producing AI-generated content.

In the Malaysian context, this study adds a fresh perspective on how AI-generated materials can be developed and used in actual classrooms. It demonstrates how teachers can integrate emerging technologies to develop gamified, and interactive learning resources, thereby supporting Malaysia's digital education agenda. The positive response to XTif GMath further illustrates the feasibility of empowering the teacher as developer, enabling educators to create AI-generated learning applications without requiring traditional programming expertise.

6. CONCLUSION

This study found that XTif GMath is well-received by students, demonstrating strong potential to enhance Mathematics learning through interactivity, gamification, and AI-generated content. Improvements in visual clarity, hints, and interface refinement will further strengthen the app. The findings support wider adoption of AI-enabled educational tools across Malaysian schools, addressing national priorities such as improved STEM interest and digital readiness.

Acknowledgments: The author would like to thank all students and teachers from MRSM Kuala Klawang for their contributions and support in completing this research.

References

- Bandura, A. (1977). Self-efficacy: Toward a Unifying Theory of Behavioral Change. *Psychological Review*, 84(2), 191–215. <https://doi.org/10.1037/0033-295X.84.2.191>
- Braun, V., & Clarke, V. (2021). *Thematic analysis: A practical guide*. SAGE Publications.
- Chen, X., Zou, D., & Xie, H. (2023). Artificial Intelligence–Generated Diagrams in Education: Opportunities and Challenges. *Computers & Education: Artificial Intelligence*, 4, 100132. <https://doi.org/10.1016/j.caeai.2023.100132>
- Clark, R. C., & Mayer, R. E. (2016). *E-learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning* (4th ed.). Wiley.
- Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From Game Design Elements to Gamefulness: Defining “Gamification.” In *Proceedings of the 15th International Academic MindTrek Conference* (pp. 9–15). ACM. <https://doi.org/10.1145/2181037.2181040>
- Gopal, R., Singh, V., & Aggarwal, A. (2020). Impact of Online Learning on Student Motivation and Confidence during COVID-19. *International Journal of Applied Research*, 6(6), 1–5. <https://doi.org/10.22271/allresearch.2020.v6.i6a.6690>
- Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does Gamification Work? A Literature Review of Empirical Studies. In *2014 47th Hawaii International Conference on System Sciences* (pp. 3025–3034). IEEE. <https://doi.org/10.1109/HICSS.2014.377>
- Holmes, W., Bialik, M., & Fadel, C. (2021). *Artificial intelligence in Education: Promises and Implications for Teaching and Learning* (2nd ed.). Center for Curriculum Redesign.
- Johnson, A., Wiest, L., & Van den Kieboom, L. (2020). The Effectiveness of Interactive Digital Manipulatives in Mathematics Learning. *Journal of Educational Technology & Society*, 23(4), 13–27.
- Julaihi, N. H., Halim, L., & Osman, K. (2022). Digital Learning and Mathematics Self-Efficacy among Lower Secondary Students in Malaysia. *Malaysian Journal of Learning and Instruction*, 19(2), 175–195. <https://doi.org/10.32890/mjli2022.19.2.7>
- Mansor, R., & Rosly, R. (2024). Gamification and Student Engagement in Lower Secondary Mathematics Classrooms. *Asian Journal of University Education*, 20(1), 95–110. <https://doi.org/10.24191/ajue.v20i1.25000>
- Nielsen, J. (1993). *Usability engineering*. Morgan Kaufmann.
- Rosni, N., Abdullah, N. S., & Noor, M. R. (2024). The Effectiveness of Game-Based Learning in Strengthening Form 1 Students’ Understanding of Integers and Fractions. *Jurnal Pendidikan Malaysia*, 49(1), 55–67. <https://doi.org/10.17576/JPEN-2024-49.01-06>
- Schunk, D. H. (2020). *Learning Theories: An Educational Perspective* (8th ed.). Pearson.
- Soni, R., & Sharma, D. (2021). Usability as a Predictor of E-Learning Satisfaction: A Systematic Review. *Education and Information Technologies*, 26(5), 6201–6222. <https://doi.org/10.1007/s10639-021-10592-6>
- Zulkifli, S., & Baharuddin, A. (2022). Effectiveness of Interactive Mobile Applications in Enhancing Mathematics Learning among Malaysian Form 1 Students. *Journal of Education and e-Learning Research*, 9(2), 110–118. <https://doi.org/10.20448/journal.509.2022.92.110.118>