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Role-playing game maker–based learning as a pedagogical tool for enhancing students' mathematical disposition

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Abstract

Mathematical disposition is crucial in learning mathematics, reflecting students attitudes, perseverance, curiosity, and appreciation of mathematics. However, many students still perceive mathematics as uninteresting and lack confidence in solving mathematical problems. This study aimed to evaluate the potential of an RPG Maker–based game as a pedagogical tool to support students' mathematical disposition in the topic of geometric transformation. This study employed a pre-experimental quantitative approach with a one-group pretest-posttest design, supplemented by a brief interview. The participants of this study were 21 male high school students from Bandung, West Java, Indonesia. Data were collected using a mathematical disposition questionnaire administered before and after the intervention, as well as through interviews with one teacher and one student. Quantitative data were analyzed using paired-samples t-test. The results revealed a significant improvement in students' mathematical disposition, with the average score increasing from moderate to high. The analysis confirmed a significant change in students' mathematical disposition, presenting a large effect size based on Cohen's criteria. The interview findings supported these results, indicating increased student engagement, confidence, and persistence. These results suggest that RPG Maker–based games have strong potential as a pedagogical tool for enhancing students' mathematical disposition.

Keywords: geometric transformation; mathematical disposition; pedagogical tool; role-playing game

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Introduction

The study of mathematics is considered essential at all educational levels because mathematics is useful in every other aspect of life namely, for science, commerce, and industry (Kamid et al., 2021). Furthermore, mathematics is one of major that can develop important skills in a student-self included soft-skills and hard skills. Mathematical disposition is classified as one of skills in the affective domain. This domain concerns about the capability of students to manage and control their attitudes, emotions, and habits within the learning context (Andriani et al., 2025). In accordance with that, mathematical disposition is considered as mental readiness that resulted in mathematics studies that affect the individual's, especially students, reaction to all situations and objects that are connected to mathematics (Ulia & Kusmaryono, 2021).

Mathematical disposition is demanded by students as this can contribute to student's problem-solving skills, interest in mathematics, and responsibility in learning (Ulya & Rahayu, 2021). Correspondingly, students that studies mathematics will consider about the benefit of mathematics in their life such as solving daily problems and use of mathematics in other disciplines (Syaiful et al., 2020). On the contrary. the low mathematics disposition can result in learning difficulties. Several previous studies examining the mathematics disposition on senior high school students namely, (Fairus et al., 2023), and Suliantiani et al., (2023) which both of them stated that mathematics disposition show persistently low scores around less than 50%. According to Suliantiani et al (2023), the low performance of this ability is due to student's assumption that mathematics learning tends to be uninteresting and unenjoyable.

To further explore this problem, the interview was conducted with one teacher at one of the senior high schools in Bandung, West Java. The interview results reported that students still face challenges in learning mathematics. The majority of students are likely to avoid mathematics topic as they view it as a difficult subject. In addition, student feel unmotivated during learning process because mathematics does not seem appealing to them. To address this issue, teachers require the models of mathematics instruction that may improve student's motivation and make mathematics appears to be enjoyable. Between the various models of mathematics instruction, teaching with technology is one of a modern method based on constructivist pedagogical approach (Hsieh et al., 2025). Crucially, technology integration need to align with pedagogical goals, promoting active learning and addressing diverse student's needs (Jiang, 2023; Hosseini & Kinnunen, 2021). This indicates that the role of technology in pedagogical process needs to be determined for effective integration.

Furthermore, the integration of technology may able to empower students to became an active participant in learning process, developing their critical thinking skills, digital literacy, and a sense of agency (Alam & Mohanty, 2023). In this conetxt, technology is entangled within pedagogy, the technology is just part of the component of any education and the pedagogy involving the use of technology (Fawns, 2022). This can be interpreted as indicating that that technology is one of the pedagogical tools to enhance learning process. The technology is considered a pedagogical tool if fulfilled the pedagogical approaches and assessment techniques aspect (Oyelere et al., 2022). Technology usually used in learning instruction to illustrate a topic in a joyful way.

When successfully implemented, learning instruction assisted with technology may result in fun and challenging process that can optimize the motivation and engagement on particular topic including mathematic (David & Weinstein, 2024). One of the technology applicable for use in learning mathematics is a game. Games can motivate students to assimilate the knowledge from various subject and use it in decision-making processes which, furthermore, encourages students to communicate with other participants leading to the creation of joyful learning (Adipat et al., 2021). To achieve this, learning games must be able to present mathematics as an important topic in the daily lives to enhance student's mathematic disposition. One type of game capable of relating mathematical concept through real-life context is role playing game.

Role Playing Game (RPG) is a type of game that able players to involved directly in the game by creating some plans to reach a given goal in the game (Nasution et al., 2024). Furthermore, RPG games in format of learning instruction allows students to feel the perspective of a character in game to navigating the virtual world and encountering many problems in real-life context (Dewi & Sujana, 2021). The application of role-playing game in mathematics topic can be seen in various studies such as, (Jumroh et al., 2022) and Febriani et al (2023) which both of them stated that the implementation of role-playing games effective to enhance the cognitive domain.

Existing role-playing games as pedagogical tools frequently prioritize cognitive objectives and overlook affective domain because games are inherently engaging. Consequently, role-playing games may underperform to address students' affective aspect such as perseverance, flexibility, appreciation and metacognition. Therefore, this research aims to fill that gap by investigating the potential of RPG-maker-based game as pedagogical tool to support student's mathematical disposition on geometric transformation topic.

Methods

This study employed pre-experimental design with one-group pretest-post-test approach. Pre-experimental research was chosen to be this research design to serve as a preliminary or pilot investigation that attends to explore the initial RPG maker-based game's effectiveness on single control group before conducting full-scale research with control groups. The purposive sampling method was implemented in this study due to practical constraints in organizing predetermined school schedules. This research was conducted in 11^{th}-grade at one of the private high schools in Bandung, West Java which consist of 21 students.

The school system implements a gender-segregated classroom system due to its institutional policies, and the specific class selected for this intervention consisted entirely of male students. The primary inclusion criterion was that students had not yet learned geometric transformation material. Consequently, the target population of this preliminary study was limited to students within this specific institutional framework presents a clear limitation to the study's external validity. Nevertless, the homogeneous sample provides a uniform baseline by eliminating gender-based variance in initial game engagement.

The geometric transformation material within the game was developed as central to the gameplay. Student as a player were required to solve geometric transformation problems such as calculating the maps of certain geometric transformation that related with real-life context. The Figure 1 is one of problems that presented in the game, player was guided to identify the exact (x, y) coordinates of stranded cat and determine the geometric transformation that would move it to safe landing area.

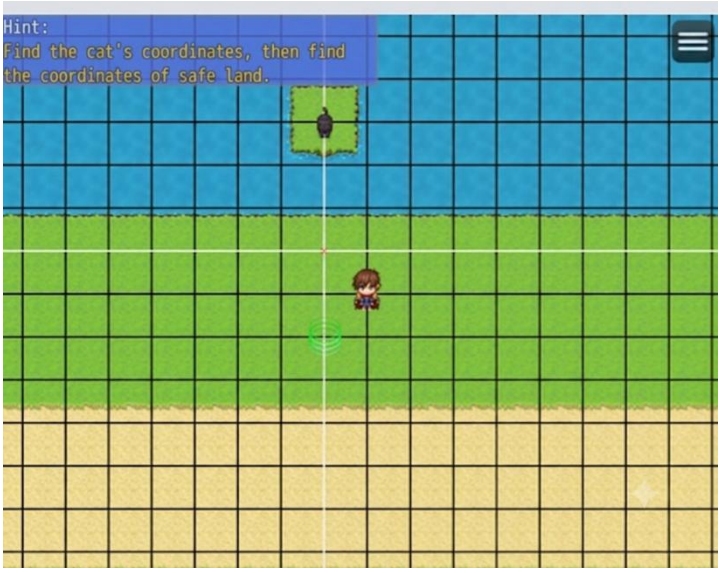

Figure 1. Game design

The RPG maker-based game utilized in this study was designed to implement the geometric transformation material into role-playing situation that included storyline and game mechanics. The game weas underwent a material and media validation before being implemented in the classroom. The validation process conducted by one material experts and one media expert that covered material presentation, language use, media design, and visual communication. Based on the expert validation, the game obtained a material validity score of 86% and media validity score of 87% which both considered as highly valid.

This research was aimed to evaluate the student's mathematical disposition. However, the mathematical disposition not only interpreted as interest in mathematics but need to be measured by the emergence of attitudes that become indicators of standards in mathematical disposition (Juharti & Kartina, 2021). As a result, the instrument of this research was a mathematics disposition questionnaire which contained 12 items of statements that based on mathematical disposition indicator in NCTM (2000). The questionnaire was used in this study due to the fact that mathematical disposition is an attitude of students which assessed by asking students as a respondent a question with multiple chose answer ranging from strongly agree to strongly disagree (Setiawan & Surahmat, 2023).

The mathematical disposition indicators were based on NCTM (1989) namely, confidence, flexibility, usefulness, perseverance, curiosity, appreciation, and metacognition. The mathematical disposition indicators can be shown in Table 1 below.

Table 1. Mathematical disposition indicator

Indicators	Descriptions
Confidence	Students have assurance that their own selves able to solving mathematic problems through the communication and reasoning process.
Flexibility	Students can explore mathematical ideas and trying out alternative methods in solving math problems.
Perseverance	Students demonstrate dedication, patience, and continuous effort to solve challenging mathematical tasks without giving up easily.
Curiosity	Students have a strong desire to know or learn something about mathematic.
Appreciation	Students recognize mathematics role as a toll and language.
Metacognition	Students have tendency to aware of their own thought processes when doing mathematics problems.

The mathematic disposition questionnaire was developed based on indicators on Table 1. The questionnaire was undergoing a content validity check through expert judgement prior to the reliability test. Two senior mathematics education lecturers evaluated the items to ensure the validity. In this questionnaire reliability test using the Cronbach's Alpha formula. The reliability test was carried out using SPSS software with bivariate correlation. The results show that Cronbach's Alpha value was 0.873 which was categorized as very high reliable.

The questionnaire was given to students before and after learning activities with role playing games. The intervention with RPG-based games was conducted over two sessions, with each session lasting 90 minutes. During these learning sessions, students played the game individually on smartphone and personal laptops while the teacher acted as a facilitator. The gameplay focused on supporting mathematical disposition by providing feedback, contextual problems, and chance to apply mathematical concepts freely. Before conducting the effect analysis, the normality test was applied to the difference scores between the post-test and pre-test as required for paired-samples. The null hypothesis (H0) for this test states that the difference scores between the test are normally distributed. The data also was analysis with paired t-test to test the differences in mathematical dispositions score before and after RPG-maker based games learning. To determine the magnitude of RPG-maker based games impact, the effect size was calculated using Cohen's for paired samples that calculated by the mean and standard deviation between post-test and pre-test.

Results

Student's mathematical disposition pretest data were obtained before getting treatment. The data is used to determine the initial state of mathematical disposition that students had. The following is data pretest result for mathematical disposition aspect.

Table 2. Mathematical disposition pre-test results

No	Indicator	Percentage (%)	Categories
1	Confidence	60.00	Moderate
2	Flexibility	62.40	Moderate
3	Perseverance	61.00	Moderate
4	Curiosity	62.90	Moderate
5	Appreciation	64.00	Moderate
6	Metacognition	67.60	Moderate

Based on Table 2, the average pretest mathematical disposition results before the RPG-maker based game was achieved 63.10%. Student's mathematical disposition post-test data were obtained after the learning with RPG-maker based game process. The data represent student's mathematical disposition after the use of RPG-maker based game on geometric transformation topic. The following Table 3 is the post test data results:

Table 3. Mathematical disposition post-test results

No	Indicator	Percentage (%)	Categories
1	Confidence	79.05	High
2	Flexibility	81.43	High
3	Perseverance	79.05	High
4	Curiosity	82.86	High
5	Appreciation	81.43	High
6	Metacognition	80.48	High

Based on Table 3, the average post-test mathematical disposition result after the RPG-maker based game learning was achieved 80.82%. Furthermore, the normality test was carried out with the SPSS software. The normality test was carried out using Shapiro-wilk test and the homogeneity test was using the Levene's statistic test with the 5% level of significance. Table 4 below are the results of the normality test on mathematical disposition pretest and post test data.

Table 4. The prerequiste test results tests of normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
gain	.135	21	.200*	.968	21	.694

Based on Table 4, the Shapiro-Wilk normality test for the gain scores yielded a significance value of 0.694, which is greater than 0.05. Therefore, the null hypothesis failed to be rejected, indicating that the gain scores follow a normal distribution. Given that the normality assumption was fully satisfied, a parametric paired-samples t-test was conducted instead of a non-parametric alternative to evaluate the differences in students' mathematical disposition before and after the intervention.

The Table 5 below are the results of Wilcoxon signer-rank test between pre-test and post-test mathematical disposition scores.

Table 5. Paired Samples T-test results

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	pretest	44.1905	21	4.89509	1.06820
	postest	56.5714	21	.81064	.17690

Paired Sample T-test

	t	df	Significance	
			One-Sided p	Two-Sided p
pretest - postest	-11.844	20	<.001	<.001

Table 5 presents the results of the paired-samples t-test that used to evaluate the significance in students' mathematical disposition before and after the intervention with RPG maker games. The students' average mathematical disposition score showed a substantial increase from the pre-test ($M = 44.19, SD = 6.22$) to the post-test ($M = 56.57, SD = 0.81$). The paired-samples t-test confirmed that this improvement was statistically significant, $t(20) = -11.844,\ p < .001$. To evaluate the practical magnitude of this statistically significant change, an effect size analysis was conducted. The standardized result of this measurement using Cohen's d parameter is presented in Table 6 below:

Table 6. Paired samples effect sizes

Paired Samples Effect Sizes			Standardizer[a]	Point Estimate	95% Confidence Interval	
					Lower	Upper
Pair 1	pretest - postest	Cohen's d	4.79037	-2.585	-3.480	-1.674
		Hedges' correction	4.97988	-2.486	-3.347	-1.611

Table 6 presents the effect sizes of the RPG maker games using Cohen's d and Hedges' correction parameters. The standardized point estimate for Cohen's d yielded a value of -2.585, with a 95% Confidence Interval ranging from a lower bound of -3.480 to an upper bound of -1.674. Concurrently, the point estimate for Hedges' correction was calculated at -2.486, with a 95% Confidence Interval between -3.347 and -1.611. Based on standard statistical conventions, these values exceed the threshold of 0.80, placing the magnitude of the change within the large effect size category.

The interview was also conducted to verify the mathematical disposition answer that student have. Furthermore, the interview was aimed to describe student's and teacher view about RPG-maker games as a pedagogical tool. The interview was conducted to one student and one teacher in the same one of the senior high schools in Bandung, West Java. This interview results with one of the students that was randomly chosen can be seen in below:

Researcher (R) : "How do you respond to difficult mathematics problems after learning through an RPG Maker-based game?"

Student (S) : "After learning through the RPG Maker game, I try to solve the difficult problem by collecting the data similar to what is done in the game."

The following is an interview result with one of the teachers:

Researcher (R) : "Is RPG Maker suitable as a pedagogical tool in mathematics learning?"

Teacher (T) : "I think the use of RPG Maker is increasing students' engagement and persistence. It helps students develop a more positive attitude toward mathematics; they now realize that mathematics topics can be learned through enjoyable games."

The interview results were then analysed to describe RPG-maker based games as a pedagogical tool. The analysis focused on students' learning experiences and teachers' perspectives regarding the use of the game in mathematics learning. The interview data were used to support and strengthen the quantitative findings obtained from the mathematical disposition questionnaire.

Discussion

Mathematical disposition is a mental state that students experience towards mathematic which is a propensity to shows positive attitudes during learning process. Student's mathematical disposition is represented in their act. The novelty of this study is to see that the mathematical disposition may be improved by the implementation of RPG-maker game. The RPG-maker game that has been employed in this study has been validated and obtained a valid score. The game was designed by integrating geometric transformation content into story-driven missions and problem-solving tasks, allowing students to engage with mathematical concepts through gameplay. In this way, mathematical activities were embedded as an essential component of the game rather than as separate instructional elements. The following Figure 2 is a game representation:

Figure 2. RPG game representation

Based on the preliminary interview, the students do not feel curious when learning mathematic resulting in low appreciation of the role of mathematics as language even tool to solve everyday problems. According to Ulia & Kusmaryono (2021), these components namely, attention, curiosity, interest while studying mathematics are associated with mathematical disposition. Furthermore, the developed game was consisted with various task about geometric transformation. These tasks were represented with such form of battle that appealing to students. There are also problems in everyday context that require geometric transformation concepts to be solved. This in line with Andriani et al (2025) study that stated that the evaluation task should base on the ability of students to apply their knowledge and skills in relevant context.

Based on the mathematical disposition post-test result, it can be seen that the perseverance aspect of student's reach high categories. This improvement can be addressed to the specific feedback from RPG-Maker, where players are shown the direct consequences of their actions. For instance, if a player inputs an incorrect translation then the character is moved to those exact coordinates potentially causing a fatal outcome such as falling into water and triggering a game over. This approach is inline with Liu & Hwang (2024), who stated that conventional games providing only immediate error correction rather than specific feedback are less effective for complex learning. Furthermore, the students' curiosity and appreciation also reached high

categories. This can be explained by the game's world building and contextual problems. This RPG Maker game offers players the opportunity to solve problems using geometric transformation concepts within an engaging environment. As a Syaiful et al (2020) stated that the mathematical learning needs to influence the student's perspective to view mathematics as a beneficial tool to solve daily problems in other disciplines. The game itself was also given enough guides so the students may solve the challenges. This also in line with Hui & Mahmud (2023) studies, which emphasized that dynamic environment may help learning process. RPG-maker game was also presented by the teacher to avoid student's confusion during mathematics learning. The game was given freedom for students to explore geometric transformation concepts.

Based on the mathematical disposition post-test result, it can be seen that the student's curiosity and appreciation reached high categories which indicates that the students have a strong desire to learn about geometric transformation topic and have a recognition that mathematics is language in everyday-context. This solved problems that occurred in Suliantiani et al (2023) studies that students assume mathematics learning to be not engaging or enjoyable. One of the challenges that happened in game-based learning that students feel gamified teaching irrelevant or disconnected from learning objectives (Jääskä & Aaltonen, 2022). Consequently, the geometric transformation content implemented as the core of game which means that all of the aspect in the games revolves around it. This is due to the fact that mathematically rich educational games must be focused on mathematical content so the mathematical should be the main part of the game (Russo & Russo, 2020). The RPG-maker based game was developed

The interview results with one of the students revealed that the problem-solving process is easier with the aid of RPG-maker game. This may be attributed to the problem in RPG-maker game that efective and efficient enough to help students understand the geometric transformation topic and helpful enough to teach students how to solve a problems. Furtermore, the interview results with one of the teacher stated that RPG-maker game able to increase student's engagement and persistence. The use of game revealed a positive outcome and created enthusiasm to students for continues learning. Moreover, the use of this technology is one of constructivist appoach (Hsieh et al., 2025). The RPG-maker is fulfilled the pedagogical approaches such as learning theory, ease of learning, and satisfaction aspect. The assessment techniques of games were also effective and helpful. Based on Oyelere et al (2022), the RPG maker-based game is considered a pedagogical tool.

These findings suggest that the RPG Maker–based game shows potential as a supportive pedagogical tool for enhancing students' mathematical disposition in geometric transformation. The development of this RPG Maker-based game also provides a valuable foundation for addressing the gaps identified in previous studies. Specifically, Jääskä & Aaltonen (2022) studies where students often perceive gamified teaching as disconnected from learning objectives. Despite the positive result, this preliminary study has several limitations that must be addressed. The study employed a pre-experimental one-group design without a control or comparison group that might be able to isolate the true effect of the intervention. Therefore, the observed improvements in student's mathematical disposition could be affected by internal validity threats such as student's natural learning progression and practice effects from taking

the initial pre-test. Therefore, the findings should be interpreted cautiously as an initial exploration rather than comprehensive proof of RPG-maker based game intervention.

Conclusion

As a preliminary investigation, this research suggested that the RPG Maker–based game shows promising potential as a supportive pedagogical tool for enhancing students' mathematical disposition in the topic of geometric transformation. The results of the hypothesis test show a significant difference in students' mathematical disposition before and after the implementation of the game, with the disposition category improving from moderate to high. These findings indicate that the use of an RPG Maker–based game can positively influence students' confidence, perseverance, curiosity, and appreciation of mathematics. Therefore, this study contributes preliminary empirical evidence regarding the potential of RPG Maker–based games to support students' mathematical disposition in mathematics learning. To validate these initial findings, future research should employ randomized controlled trials with larger sample sizes and longer intervention periods. Investigating the game's impact across diverse student populations and different mathematical topics is also highly recommended to establish more definitive proof of its pedagogical effectiveness.

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Declarations

Conflicts of Interest	:	Authors have no competing interests. In addition, the writers have addressed ethical concerns like plagiarism, misconduct, data fabrication and falsification, double publishing and submission, and redundancy.
Generative AI Statement	:	AI Used for Limited, Non-Substantive Support: Translation tools and built-in proofreading software, such as Google Translate and Microsoft Editor, were employed solely for English translation, grammar checking, and identifying typographical errors. All conceptualization, analysis, and scholarly content were independently developed and verified by the authors.
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Author Contributions	:	**Alim Wicaksono:** softawre, formal analysis, writing original draft; **Al Jupri:** conceptualization, validation, supervision. **Tatang Herman:** conceptualization, review, supervision;

References

Adipat, S., Laksana, K., Busayanon, K., Ausawasowan, A., & Adipat, B. (2021). Engaging students in the learning process with game-based learning: The fundamental concepts. *International Journal of Technology in Education*, *4*(3), 542–552. https://doi.org/10.46328/ijte.169

Alam, A., & Mohanty, A. (2023). Educational technology: Exploring the convergence of technology and pedagogy through mobility, interactivity, AI, and learning tools. *Cogent Engineering*, *10*(2). 1-37 https://doi.org/10.1080/23311916.2023.2283282

Andriani, A., Syahfitri, D. V., & Manurung, A. P. (2025). Evaluation of learning in cognitive, affective and psychomotor aspects in junior high school. *Indonesian Journal of Education and Mathematical Science*, *6*(1), 25–29.

David, L., & Weinstein, N. (2024). Using technology to make learning fun: Technology use is best made fun and challenging to optimize intrinsic motivation and engagement. *European Journal of Psychology of Education*, *39*(2), 1441–1463. https://doi.org/10.1007/s10212-023-00734-0

Dewi, N. L. P. J., & Sujana, I. W. (2021). Learning multimedia based on RPG maker MV material for circumference and area of flat shapes for elementary school students. *Journal of Education Technology*, *5*(3), 365-374. https://doi.org/10.23887/jet.v5i2.34462

Fairus, F., Fauzi, A., & Sitompul, P. (2023). Analisis kemampuan disposisi matematis pada pembelajaran matematika siswa SMKN 2 Langsa [Analysis of mathematical disposition ability in mathematics learning of SMKN 2 Langsa Students] .*Jurnal Cendekia : Jurnal Pendidikan Matematika*, *7*(3), 2382–2390. https://doi.org/10.31004/cendekia.v7i3.2549

Fawns, T. (2022). An entangled pedagogy: Looking beyond the pedagogy—technology dichotomy. *Postdigital Science and Education*, *4*(3), 711–728. https://doi.org/10.1007/s42438-022-00302-7

Febriani, S. W., Sandie, S., & Darma, Y. (2023). Game edukasi matematika berbantuan RPG maker MV materi bangun datar terhadap kemampuan pemecahan masalah matematis [Mathematics educational game assisted by RPG maker MV on plane geometry material and its effect on mathematical problem-solving ability]. *Teorema: Teori Dan Riset Matematika*, *8*(1), 172-180. https://doi.org/10.25157/teorema.v8i1.9936

Hosseini, Z., & Kinnunen, J. (2021). Integration of pedagogy into technology: A practical paradigm. *Education and New Developments 2021*, 406–410. https://doi.org/10.36315/2021end086

Hsieh, F.-J., Wang, T.-Y., Hsieh, C.-J., & Chu, C.-T. (2025). The relationships of preservice teachers' dispositions and noticing of technology-integrated mathematics teaching activities. *ZDM – Mathematics Education*, *57*(6), 1139–1152. https://doi.org/10.1007/s11858-025-01727-7

Hui, H. B., & Mahmud, M. S. (2023). Influence of game-based learning in mathematics education on the students' cognitive and affective domain: A systematic review. *Frontiers in Psychology*, *14*. 1-15. https://doi.org/10.3389/fpsyg.2023.1105806

Jääskä, E., & Aaltonen, K. (2022). Teachers' experiences of using game-based learning methods in project management higher education. *Project Leadership and Society*, *3*, 100041. https://doi.org/10.1016/j.plas.2022.100041

Jiang, M. (2023). The impact and potential of educational technology: A comprehensive review. *Research and Advances in Education*, *2*(7), 32–49. https://doi.org/10.56397/RAE.2023.07.05

Juharti, N., & Kartina, L. (2021). Comparison of student learning outcomes in class VIII SMP Negeri 2 Muaro Jambi. *Integrated Science Education Journal*, *2*(1), 13–19.

Jumroh Jumroh, Fitriani, A., & Fitriasari, P. (2022). Development of a game-based test instrument using RPG maker MZ software on exponential functional materials. *International Journal of Computer Applications Technology and Research*, 1–7. https://doi.org/10.7753/IJCATR1201.1001

Kamid, K., Huda, N., Syafmen, W., Sufri, S., & Sofnidar, S. (2021). The relationship between students' mathematical disposition and their learning outcomes. *Journal of Education and Learning (EduLearn)*, *15*(3), 376–382. https://doi.org/10.11591/edulearn.v15i3.17604

Liu, L., & Hwang, G. (2024). Effects of metalinguistic corrective feedback on novice EFL students' digital game-based grammar learning performances, perceptions and behavioural patterns. *British Journal of Educational Technology*, *55*(2), 687–711. https://doi.org/10.1111/bjet.13400

Nasution, N. E. A., Yasin, R., & Rizka, C. (2024). Development of an RPG maker MV-based interactive game as learning media on virus materials for grade X students at Nurul Islam Jember senior high school. *Jurnal Pendidikan Matematika dan IPA*, *15*(3), 457-475. https://doi.org/10.26418/jpmipa.v15i3.74029

Oyelere, S. S., Agbo, F. J., & Sanusi, I. T. (2022). Developing a pedagogical evaluation framework for computational thinking supporting technologies and tools. *Frontiers in Education*, *7,* 1-17. https://doi.org/10.3389/feduc.2022.957739

Russo, J., & Russo, T. (2020). Transforming mathematical games into investigations. *Australian Primary Mathematics Classroom*, *25*(2), 14–19.

Setiawan, Y. E., & Surahmat. (2023). The effect of mathematical disposition on basic mathematical abilities in the online learning. *Journal of Education Research and Evaluation*, *7*(2), 259–266. https://doi.org/10.23887/jere.v7i2.58437

Suliantiani, N. M., Sridana, N., Triutami, T. W., & Soepriyanto, H. (2023). Analisis kecemasan dan disposisi matematis terhadap hasil belajar ditinjau dari gaya belajar matematika siswa kelas XI di SMA Negeri 2 Gerung Tahun Pelajaran 2022/2023 [Analysis of anxiety and mathematical disposition on learning outcomes viewed from the learning styles of class xi students at SMA Negeri 2 Gerung for the 2022/2023 Academic Year]. *Jurnal Ilmiah Profesi Pendidikan*, *8*(3), 1499–1508. https://doi.org/10.29303/jipp.v8i3.1524

Syaiful, S., Kamid, K., Muslim, M., Huda, N., Mukminin, A., & Habibi, A. (2020). Emotional quotient and creative thinking skills in mathematics. *Universal Journal of Educational Research, USA*, *8*(2), 499–507.

Ulia, N., & Kusmaryono, I. (2021). Mathematical disposition of students, teachers, and parents in distance learning: A survey. *Premiere Educandum: Jurnal Pendidikan Dasar Dan Pembelajaran*, *11*(1). 147- 149. https://doi.org/10.25273/pe.v11i1.8869

Ulya, H., & Rahayu, R. (2021). Mathematical disposition of students in open-ended learning based on ethnomathematics. *Journal of Education Technology*, *5*(3), 339–345.