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Ethnomathematics-Based Math Quest (Mathematical Adventure Quest) to Enhance Critical Mathematical Thinking in Elementary Education

Salwa Sayidina Kansa[1]*, Dewi Tryanasari[1], Sri Lestari[1]
[1]Department of Elementary School Teacher Education, Universitas PGRI Madiun, Indonesia
*salwa_2202101047@mhs.unipma.ac.id

Abstract

Mathematical critical thinking skills are important skills that need to be developed in elementary school students. However, observations in grade V of SDN Jiwan 01 showed that students still had difficulties in analyzing contextual problems, determining solution strategies, and relating mathematical concepts to everyday life. This study aims to improve students' mathematical critical thinking skills through the application of ethnomathematics-based Math Quest (Mathematic Adventure Quest) media on the circumference of flat shapes. The study used a collaborative Classroom Action Research (CAR) method which was implemented in two cycles, including planning, implementation, observation, and reflection. The research subjects consisted of 26 grade V students of SDN Jiwan 01, Madiun Regency. Data collection techniques included observation, tests, and documentation. The results showed an increase in students' mathematical critical thinking skills after the application of ethnomathematics-based Math Quest media. The students' average score increased from 71.51 in the pre-cycle to 79.20 in cycle I and 86.89 in cycle II. The classical completion percentage also increased from 50% to 65.3% and 84.61%. Thus, the ethnomathematics-based Math Quest media effectively improves elementary school students' critical mathematical thinking skills.

Keywords: Critical mathematical thinking; Ethnomathematics, Math quest; Learning media; Classroom action research.

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INTRODUCTION

Central to 21st-century mathematics education is the enhancement of learners' critical thinking. Moving past rote formulas and arithmetic procedures, mathematics functions as a tool to develop the logical reasoning, analysis, problem-solving, and decision-making necessary to tackle complex real-world challenges (Rahmaini & Ogylva Chandra, 2024; Tarteer & Ismail, 2020). Hence, mathematics education ought to empower students to actively synthesize knowledge, analyze real-life issues, weigh various solutions, and reflect on their internal thought patterns. Such an approach is bound to stimulate higher-level cognition, especially

critical mathematical thinking, which is foundational to long-term academic growth and lifelong education (Rodríguez-Silva, Cuevas, & Violant-Holz, 2025).

Despite being essential, nurturing critical thinking within mathematics remains a prominent issue at the elementary level. This ability empowers students to bridge different mathematical concepts, evaluate information, critique potential solutions, and deduce logical answers when solving mathematical problems (Erdogan & Koçyigit, 2025). However, prior investigations consistently reveal a deficit in mathematical reasoning and problem-solving proficiency among Indonesian elementary students, pointing to the fact that their critical thinking skills remain underdeveloped (Danoebroto, et al., 2026). Consequently, these results highlight the need for math pedagogy to balance computational skills with the development of students' reflective thinking and reasoning capabilities.

Various factors impede the growth of critical mathematical cognition. Studies consistently show that minimal instructional innovation, teacher-centered approaches, low academic drive among learners, and conceptual hurdles in mathematics collectively obstruct the realization of meaningful learning outcomes (Gilmore, 2023). Specifically in geometry education, young students frequently encounter difficulties defining the characteristics of 2D shapes and applying relevant mathematical formulas to practical, everyday scenarios (Andini & Cahyaningsih, 2024). This leads to a common issue where students memorize formulas superficially instead of mastering the core concepts, thereby hindering the growth of their reasoning and analytical aptitude.

A baseline assessment at SDN Jiwan 01, Madiun Regency (Grade V), mirrored these findings. Observations and teacher interviews revealed that although students understood elementary mathematical concepts, they experienced major setbacks with contextual problems that required analytical and systematic thinking. This difficulty was compounded by a teacher-centered approach, a heavy reliance on textbooks, and a lack of digital learning media, all of which led to student passivity. As a result, students were unable to isolate key data, select appropriate problem-solving strategies, or explain their reasoning clearly. Ultimately, these results confirm that students' critical mathematical thinking skills are underutilized and demand the implementation of innovative instructional methods.

To address these challenges, leveraging digital-based educational games offers significant potential (Ramli, Maat, & Khalid, 2023). This strategy provides an interactive framework that encourages students to explore, collaborate, and solve problems actively, effectively raising their learning motivation and satisfaction (Muhaimin, Wardani, Harianingsih, Subali, & Widiati, 2025). This situation demands innovation in the learning process specifically designed to enhance students' critical mathematical thinking skills. Teachers are required to think innovatively and not be fixated on conventional learning patterns, especially when designing learning media that can encourage active student engagement (Ramli, Maat, & Khalid, 2023). Various media can be considered and designed to stimulate students' critical thinking skills, namely through media that can position students as the main orientation (Meryansumayeka, Zulkardi, Putri, & Hiltrimartin, 2022). Moreover, utilizing ethnomathematics to integrate regional culture makes learning more relatable, since students can explore mathematical concepts through familiar cultural practices (Batiibwe, 2024). Thus, the synergy between game-based

learning and ethnomathematics can drive a more comprehensive conceptual grasp, while at the same time cultivating critical thinking within mathematics education.

Although the individual benefits of gamified learning on motivation and ethnomathematics on contextual learning are well-documented, limited initiatives have integrated both into a digital learning tool specifically tailored for elementary students' critical mathematical thinking (Elhilal, 2025). Moreover, classroom action research exploring adventure games with ethnomathematical content to facilitate student reasoning is scarce (Meeran & Davids, 2022). To resolve this limitation, this research introduces *Math Quest* (Mathematical Adventure Quest)—an ethnomathematics-based educational game combining interactive gameplay with contextual problems to elevate students' critical thinking.

Grounded in theory, previous findings, and baseline observational data, this study intends to foster critical mathematical thinking among fifth-grade elementary students by implementing *Math Quest*, an ethnomathematics-based educational game centered on the perimeter of plane figures. These findings aim to contribute to contemporary discourse on innovative mathematics education while serving as a practical guide for integrating gamification and ethnomathematics at the primary school level.

RESEARCH METHOD

A collaborative Classroom Action Research (CAR) approach was adopted in this study to foster critical mathematical thinking skills via the implementation of *Math Quest*, an ethnomathematics-based educational medium. This collaborative strategy facilitated joint efforts between the researcher and the teacher in identifying problems, introducing instructional changes, observing classroom activities, and assessing intervention outcomes. Guided by the Kemmis and McTaggart model, the research progressed through four interconnected stages: planning, action, observation, and reflection (Kemmis, McTaggart, & Nixon, 2014). The project was carried out across two cycles, with the reflective data from the first cycle serving to refine and enhance the teaching and learning processes in the subsequent cycle.

Conducted during the second semester of the 2025/2026 academic year at SDN Jiwan 01 (Jiwan District, Madiun Regency), this study involved 26 fifth-grade participants (16 females and 10 males). Purposive selection was justified by baseline observations showing that these students encountered significant difficulties with contextual math problems requiring higher-level analysis. Rather than engaging deeply with mathematical scenarios, students routinely memorized formulas, resulting in weak critical thinking skills in the classroom. During the implementation, a collaborative framework was maintained; the teacher delivered the curriculum as the active instructor, while the researcher monitored the environment as an observer.

The intervention centered on *Math Quest*, a digital game-based learning medium infused with ethnomathematics to foster critical thinking through contextual problem-solving. This platform combines adventure game loops with Indonesian cultural contexts, allowing students to learn mathematics through meaningful cultural references. Targeting plane geometry and the perimeter of 2D shapes, the instructional activities required students to complete milestones: identifying geometry in cultural objects, solving contextual math puzzles,

discussing strategies in groups, and accessing immediate game feedback. Students worked cooperatively in small clusters under the teacher's guidance, who steered the problem-solving and encouraged self-reflection. The synergy of digital gaming and ethnomathematics was anticipated to boost student motivation, reasoning skills, and critical mathematical proficiency.

Three types of research instruments were deployed for data collection. First, observation sheets tracked teacher instruction and student involvement during the *Math Quest* implementation. Second, an essay-based critical thinking test was administered at each cycle's conclusion, utilizing Facione's core indicators: interpretation, analysis, inference, evaluation, explanation, and self-regulation. Third, documentation such as classroom photos, worksheets, lesson plans, observation summaries, and test scores was collected to validate the findings. To ensure alignment with research goals, clarity, and content validity, all instruments were peer-validated by two mathematics education experts and one elementary education specialist. The instruments were revised based on their critiques before being applied in the field.

Table 1. Research Instruments

Instrument	Purpose	Data Collected
Observation sheet	Evaluate learning implementation	Teacher activities and students' participation
Mathematical critical thinking test	Measure improvement in critical thinking skills	Students' critical thinking scores
Documentation	Support research findings	Lesson plans, photographs, worksheets, assessment documents

Table 2. Blueprint of Mathematical Critical Thinking Test

Critical Thinking Indicator	Sub-indicator	Sample Learning Indicator
Interpretation	Identifying known and required information	Students identify information presented in contextual problems.
Analysis	Analyzing relationships among mathematical concepts	Students determine relationships among geometric figures and mathematical concepts.
Inference	Drawing logical conclusions	Students formulate appropriate mathematical conclusions based on problem data.
Evaluation	Evaluating solution strategies	Students assess whether their solution strategy is correct and efficient.
Explanation	Providing logical justification	Students explain each step of their mathematical reasoning.
Self-regulation	Reviewing and correcting solutions	Students recheck calculations and revise incorrect answers independently.

Cycles and Framework The study followed a two-cycle CAR model consisting of planning, action, observation, and reflection. Planning involved designing

lessons, worksheets, media, and assessments. During the action phase, the teacher conducted lessons using the ethnomathematics-infused *Math Quest*, while the researcher documented teacher and student behaviors. The reflection phase focused on a collaborative analysis of test scores and observations to identify necessary pedagogical improvements for the next cycle. The research concluded when all success criteria were satisfied.

Data Processing Both quantitative and qualitative methods were utilized for data analysis. Quantitative analysis involved computing the mean scores and classical mastery percentages from the critical thinking tests (pre-cycle, Cycle I, and Cycle II) to measure improvement. Qualitative data from observations and documentation were analyzed through reduction, display, and conclusion drawing. Triangulation across test scores, observation records, and documentation was implemented to maximize research credibility.

Ethical Protocols Formal institutional permission was obtained from the principal and teacher beforehand. Students participated on a voluntary basis, and all data were anonymized and protected under strict confidentiality guidelines for research purposes only.

RESULTS AND DISCUSSION

Result

The CAR framework for this study spanned two full cycles, wherein each cycle followed the standard loop of planning, execution, observation, and reflective analysis.

Growth in Critical Mathematical Thinking

Implementing the ethnomathematics-based *Math Quest* learning platform successfully enhanced primary students' critical thinking proficiency over the course of the CAR cycles. Evaluation of student progress relied on mathematical critical thinking tests given at the pre-cycle, Cycle I, and Cycle II benchmarks. The comparative trajectory of these learning outcomes is detailed in Table 3.

Table 3. Summary of Students' Mathematical Critical Thinking Achievement Across Cycles

Research Stage	Mean Score	Students Achieving Mastery	Students Below Mastery	Classical Mastery (%)
Pre-cycle	71.51	13	13	50.00
Cycle I	79.20	17	9	65.30
Cycle II	88.89	22	4	84.61

According to Table 3, students demonstrated consistent progress in mathematical critical thinking throughout the study. The initial pre-cycle mean score of 71.51 highlights that students' critical thinking abilities were initially low, as only 13 of the 26 participants (50.00%) reached the baseline mastery criterion. The rest of the class routinely struggled with contextual math problems that required advanced analysis and logical judgment.

Driven by reflective improvements, Cycle II yielded even higher outcomes: the mean score reached 88.89 (a 17.38-point increase from the pre-cycle), and the number of mastering students grew to 22. This resulted in a classical mastery rate

of 84.61%, indicating that the majority of fifth-graders successfully developed strong critical thinking skills. In short, these outcomes validate that the ethnomathematics-based *Math Quest* application consistently drives cumulative improvements in students' mathematical reasoning.

After implementing *Math Quest* in Cycle I, the mean score improved to 79.20, and the number of mastering students grew from 13 to 17, elevating the classical mastery percentage to 65.30%. While still short of the final target criteria, this shift proved that the ethnomathematics-based intervention was highly effective in initiating positive developments in students' critical thinking skills.

Driven by reflective improvements, Cycle II yielded even higher outcomes: the mean score reached 88.89 (a 17.38-point increase from the pre-cycle baseline), and the number of mastering students grew to 22. With only 4 students remaining below the minimum standard, the classical mastery rate reached 84.61%. This indicates that the majority of fifth-graders successfully developed strong critical thinking skills after participating in the ethnomathematics-infused *Math Quest* activities.

In short, these outcomes validate that the ethnomathematics-based *Math Quest* media successfully drives cumulative and consistent improvements in students' mathematical reasoning throughout the study.

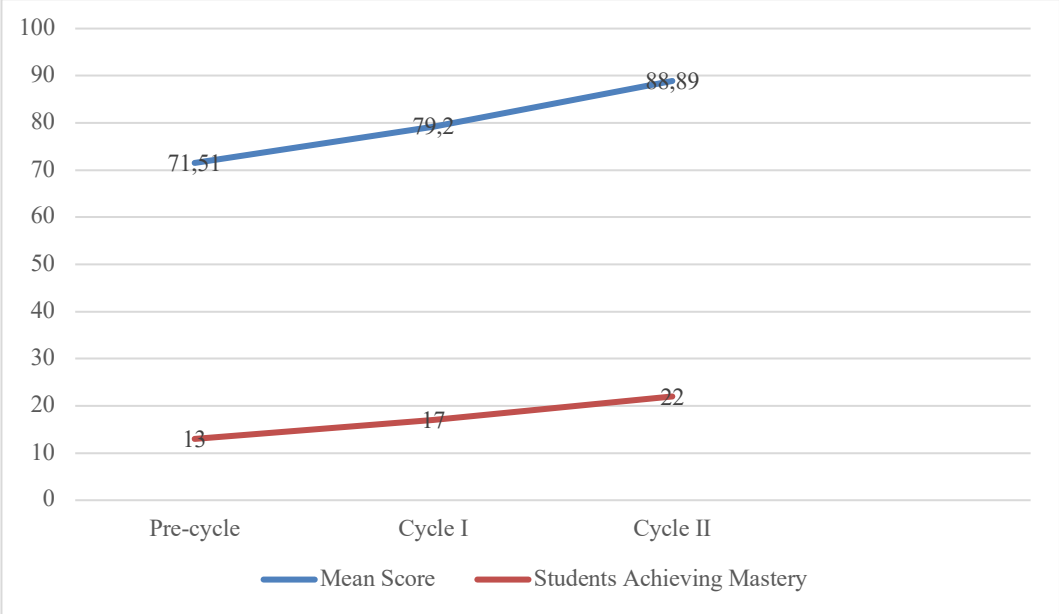

Figure 1. Improvement in Students' Mean Scores Across Research Stages

Figure 1 demonstrates a clear, cumulative growth in students' average mathematical critical thinking scores from the pre-cycle benchmark to Cycle II. This steady progress validates that the ethnomathematics-based *Math Quest* learning media successfully drove consistent improvements in students' mathematical reasoning over the course of the CAR cycles.

Variations in Students' Mathematical Critical Thinking Levels

Apart from boosting overall academic marks, the strategy successfully altered the dispersion of students' critical mathematical thinking levels. Students were grouped into low, moderate, and high categories according to their individual test

performance. The breakdown of student placement across these classifications during each investigative phase is compiled in Table 4.

Table 4. Classification Breakdown of Critical Thinking Levels by Research Stage

Critical Thinking Level	Pre-cycle	Cycle I	Cycle II
High	3	9	16
Moderate	10	8	6
Low	13	9	4

Table 4 demonstrates a marked shift in critical thinking levels after the intervention. Initially, only 3 students ranked in the high category, while 13 were in the low tier due to baseline difficulties with data interpretation, strategy selection, and logical justification. This uneven distribution highlights that most learners initially lacked the foundational skills required to process contextual mathematical problems effectively.

In Cycle I, the implementation of *Math Quest* tripled the number of highly skilled students to 9 and reduced the low-tier group to 9. Despite remaining challenges for some in independent problem-solving, the overall distribution confirms enhanced mathematical reasoning and understanding.

By Cycle II, following instructional refinements, 16 students achieved high critical thinking status, while only 4 remained in the low group. The moderate category also decreased from 10 to 6, confirming that many students successfully advanced from intermediate to high performance.

In short, these results prove that integrating the ethnomathematical *Math Quest* tool successfully enhanced average academic marks while simultaneously yielding a significant realignment in the collective dispersion of students' critical thinking levels.

Observation of Learning Behaviors

Qualitative observation data strongly corroborated the quantitative improvements seen in the mathematical critical thinking scores. Early on, in the pre-cycle and the beginning of Cycle I, students routinely found it difficult to grasp math problems embedded in everyday contexts. Instead of analyzing the mathematical scenarios, they relied mostly on memorizing formulas without explaining their choices, causing classroom discussions to be driven by only a few active participants.

Driven by the reflection findings from Cycle I, key instructional modifications were made in Cycle II. The teacher provided clearer instructions on using *Math Quest*, formed more balanced collaborative student teams, and encouraged equal participation among all group members. Extra scaffolding was also integrated to help students break down contextual problems before choosing their mathematical approaches.

These strategic adjustments generated significant changes in student behaviors in Cycle II. Cooperation within small groups improved, students presented solutions with more confidence, and they actively defended their steps using logical reasoning. They also successfully connected the game's ethnomathematical content with formal concepts regarding the perimeter of 2D shapes.

Overall, classroom monitoring indicated that *Math Quest* built an interactive, engaging, and reflective environment. These qualitative results aligned perfectly

with the quantitative gains in mathematical critical thinking scores, confirming that the intervention facilitated concurrent growth in student participation and intellectual development.

Discussion

Overall, the data demonstrates that the ethnomathematics-based *Math Quest* platform effectively upgraded students' mathematical critical thinking proficiencies. Rather than merely raising final scores, the intervention sparked meaningful adjustments in how students interpreted contextual tasks, engaged in collaborative team problem-solving, and justified their mathematical steps. These findings validate that pairing digital educational games with cultural elements shifts the classroom dynamic from passive listening toward active, higher-order mathematical inquiry.

The continuous growth during the intervention stemmed from several key factors. First, *Math Quest* converted traditional math lessons into an interactive journey where students tackled math problems through structured game challenges. Instead of just memorizing 2D perimeter formulas, students were trained to identify key data, select proper strategies, evaluate options, and explain their logical reasoning. This approach aligns perfectly with constructivist learning, which states that knowledge is built through active engagement with meaningful tasks (Arega & Hunde, 2025). Ultimately, this shifted students from being passive recipients of formulas to becoming active participants in the learning process.

Furthermore, pairing *Math Quest* with Problem-Based Learning (PBL) syntax allowed students to solve contextual math problems in teams. During these sessions, students discussed alternative methods, compared different approaches, and defended their reasoning during class presentations (Rapanta & Felton, 2022). These activities directly triggered higher-order thinking—including analysis, evaluation, logic, and reflection—which form the core of mathematical critical thinking (Yadav & Singh, 2026). Observations also confirmed that students grew more confident in sharing ideas, asking questions, and responding to peers. These collaborative dynamics allowed students to sharpen their reasoning through discussion and feedback, ultimately boosting both their conceptual understanding and communication skills.

Furthermore, embedding ethnomathematics into *Math Quest* significantly optimized the study's outcomes. While conventional math classes often teach concepts abstractly, ethnomathematics links curriculum content with students' cultural backgrounds and daily lives (Yanti, 2025). By framing perimeter problems of two-dimensional figures within local cultural contexts, students could easily see the real-world application of math (Asare, 2025). This culturally meaningful approach drove deeper interpretation, helped students connect mathematical concepts to real-world phenomena, and facilitated active knowledge construction (Koskinen & Pitkäniemi, 2022). Ultimately, students did not just generate correct answers; they demonstrated a significantly stronger capability to defend and explain their mathematical problem-solving steps (Nurlela, et al., 2025).

Additionally, ethnomathematics strengthened conceptual clarity by connecting abstract math ideas to well-known cultural traditions, effectively reducing the cognitive load (Luecke, 2025). *Math Quest* provided contextual representations that helped students visualize geometric properties concretely before applying abstract

procedures. This shifted their perception of mathematics from a set of isolated equations to a practical tool for decoding everyday cultural environments (Siregar & Fauzan, 2025). Ultimately, this approach significantly boosted students' analytical reasoning, mathematical judgment, and critical evaluation skills throughout the learning cycles.

Additionally, the data underscores the vital role of teamwork during the *Math Quest* study. In small groups, students analyzed contextual math challenges, shared ideas, compared approaches, and presented their results. This cooperative setup drove students to explain their math logic, evaluate peer arguments, and adjust their own understanding through peer discussions (Hewitt, 2023). From a social constructivist perspective, knowledge is built through social interaction and shared problem-solving. Thus, the collaborative framework within *Math Quest* likely acted as a central catalyst for developing students' critical thinking skills (Eswaran, 2024). This is proven by classroom observations showing that students were much more confident in sharing ideas, asking questions, and defending their mathematical reasoning in Cycle II than in the early stages.

The continuous growth across both cycles demonstrates that *Math Quest*'s success depended on both the media design and continuous instructional refinements. Post-Cycle I reflections revealed several issues: students struggled with the game's mechanics, group participation was uneven, and presentation confidence was low. To address this, the teacher provided clearer instructions, stronger scaffolding, and better group organization during Cycle II. This created a supportive environment that boosted student engagement and independent problem-solving. This finding proves that educational technology requires strong teacher pedagogical competence to facilitate truly impactful learning experiences.

This study extends current literature by demonstrating that merging educational game mechanics with ethnomathematics yields complementary benefits for students' critical mathematical thinking (Kumar & Gopinath, 2025). While previous studies focused on games for motivation or ethnomathematics for contextualization separately, this integrated approach combines digital learning, cultural contexts, collaboration, and reflective discussion (Simanjuntak, Fauzi, Mukhtar, & Sitepu, 2024). This comprehensive model forms the primary contribution of this research, proving that culturally responsive educational games can effectively strengthen higher-order thinking in elementary students (Wutsqa, Nugroho, & Wulandari, 2026).

The findings imply that mathematical critical thinking is developed best when students solve authentic, culturally relevant problems instead of doing procedural drills. *Math Quest* proves that contextual learning environments drive students to interpret data, evaluate strategies, and justify reasoning systematically (Niam & Musthofa, 2025). Therefore, elementary teachers should integrate local culture into math lessons to make abstract concepts meaningful. Furthermore, technology should not be used as a mere support tool; its success depends on the teacher’s ability to scaffold learning and facilitate discussion. Teachers must act as instructional designers who shape environments for critical thinking and independent problem-solving (Susanti, Gunansyah, & Nasution, 2025).

Several limitations must be noted. This classroom action research was limited to one fifth-grade class, a small sample size, and focused only on the perimeter of plane figures. Thus, the findings are context-specific and cannot be generalized to

all educational settings. Future research should involve larger samples, different grades, and broader math topics. Additionally, future studies should use experimental or quasi-experimental designs to provide stronger empirical evidence, while exploring long-term effects on problem-solving, creativity, motivation, and other 21st-century skills.

CONCLUSION

Ultimately, this study proves that the ethnomathematics-based *Math Quest* platform effectively improves elementary students' mathematical critical thinking skills. This success is demonstrated by consistent improvements in class averages, classical mastery percentages, and the number of students achieving high-level critical thinking status. These results confirm that integrating interactive digital media with cultural contexts successfully promotes active, higher-order mathematical reasoning in primary education.

Beyond improving grades, this research contributes to mathematics education by demonstrating that game-based learning and ethnomathematics work together to enhance understanding. Combining cultural experiences, teamwork, and digital learning drives students to construct mathematical concepts actively rather than relying on formula memorization. This integrated approach expands on earlier studies that examined games and ethnomathematics separately, providing a clearer, empirical model for developing critical thinking.

For educators and curriculum developers, these findings highlight the need to move past strict procedural teaching. Mathematics lessons should incorporate technology-supported, culturally meaningful environments that prompt students to evaluate and justify ideas. Integrating ethnomathematical digital tools provides an effective classroom alternative that promotes critical thinking while simultaneously preserving local cultural knowledge during the learning process.

Because this study was conducted in just one classroom on a single math topic, the findings are context-specific. Future research should evaluate ethnomathematics-based digital tools across different mathematical subjects, educational levels, and larger sample sizes. Further investigations should also explore their long-term impact on students' problem-solving abilities, creativity, collaboration, and other essential 21st-century skills.

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REFERENCES

Andini, I., & Cahyaningsih, U. (2024). An analysis of students' learning difficulties in solving plane geometry problems among seventh-grade students.

nternational Journal of Advance Research in Mathematics Education, 2(2), 110-121. https://doi.org/10.56916/ijr.v2i2.2657

Arega, N. T., & Hunde, T. S. (2025). Constructivist instructional approaches: A systematic review of evaluation-based evidence for effectiveness. *Review of Education, 13*(1), 70040.

Asare, B. (2025). Influence of ethnomathematics-based instruction on students' attitudes, participation, and cultural connections in mathematics learning in Ghana. *Cogent Education, 13*(1), 1-13. https://doi.org/10.1080/2331186X.2025.2612395

Batiibwe, M. S. (2024). The role of ethnomathematics in mathematics education: A literature review. *Asian Journal for Mathematics Education, 3*(4), 383-405. https://doi.org/10.1177/27527263241300400

Danoebroto, S. W., Wahyudi, W., Ulloa, O., Ulloa, O., Rizky, Syaifuddin, A., & Araya, R. (2026). Unleashing computational thinking: a novel approach to reforming Indonesian primary math instruction. *Front. Educ., 11*, 1754373. https://doi.org/10.3389/feduc.2026.1754373

Elhilal, A. (2025). Cracking the math code: the impact of flipped classroom on problem-solving, digital fluency and self-directed learning. *Cogent Education, 12*(1), 1-19. https://doi.org/10.1080/2331186X.2025.2580767

Erdogan, F., & Koçyigit, B. (2025). Critical Thinking as a Pedagogical Tool: Insights from Elementary Mathematics Teachers. *Educational Policy Analysis and Strategic Research, 20*(4), 7-29.

Eswaran, U. (2024). Project-Based Learning: FKemmis, S., McTaggart, R., & Nixon, R. (2014). Introducing Critical Participatory Action Research. In: The Action Research Planner. Dalam *The Action Research Planner.* Singapore: Springer. https://doi.org/10.1007/978-981-4560-67-2_1

Gilmore, C. (2023). Understanding the complexities of mathematical cognition: A multi-level framework. *Quarterly Journal of Experimental Psychology, 76*(9), 1953-1972. https://doi.org/10.1177/17470218231175325

Hewitt, L. C. (2023). Collaborative Learning Strategies to Build Critical Thinking and Collaboration in the Mathematics Classroom: A Qualitative Case Study. *(Doctoral dissertation, Northcentral University)*. https://doi.org/10.59613/g6stj540

Koskinen, R., & Pitkäniemi, H. (2022). Meaningful Learning in Mathematics: A Research Synthesis of Teaching Approaches. *International Electronic Journal of Mathematics Education, 17*(2), 1-15. https://doi.org/10.29333/iejme/11715

Kumar, A., & Gopinath, S. (2025). Integrating Ethnomathematics in Indian Classrooms: Strengthening Conceptual Understanding through Cultural Relevance. *Indigenous Wisdom, 1*(1), 1-22.

Luecke, D. (2025). A culturally relevant, imbued, and sustaining pedagogy framework for culturally connected math curriculum. *Frontiers in Education, 9*, 1502449. https://doi.org/10.3389/feduc.2024.1502449

Meeran, S., & Davids, M. N. (2022). Turning to Ethnomathematical Games in the Mathematics Classroom: Increasing Mathematical Thinking Skills. *Twenty-ninth International Conference on Learning*, 51.

Meryansumayeka, Zulkardi, Putri, R. I., & Hiltrimartin, C. (2022). Designing geometrical learning activities assisted with ICT media for supporting

students' higher order thinking skills. *Journal on Mathematics Education, 13*(1), 135-148. https://doi.org/10.22342/jme.v13i1.pp135-148

Muhaimin, Y. Y., Wardani, S., Harianingsih, Subali, B., & Widiati, N. (2025). Digital Based Mathematics Learning in Primary Education: Systematic Literatur Review. *Journal of Educational Sciences, 9*(4), 2138-2151. https://doi.org/10.31258/jes.9.4.p.2138-2151

Niam, M. A., & Musthofa. (2025). Math trails in mathematics education: A systematic literature review on contextual learning, student engagement, and spatial reasoning (2013 – 2025). *Jurnal Penelitian Ilmu Pendidikan, 18*(2), 157-168. https://doi.org/10.21831/jpip.v18i2.93486

Nurlela, S., Yuliyanto, A., Nurhasanah, S., Mulia, A. S., Ridwan, R. M., & Nurrahmah, J. (2025). The Influence of Mathematical Disposition on The Mathematical Problem-Solving Ability of Fifth-Grade Elementary School Students. *The 7th International Conference on Elementary Education, 7*(1), 1-13.

Rahmaini, N., & Ogylva Chandra, S. (2024). Pentingnya berpikir kritis dalam pembelajaran matematika. *Griya Journal of Mathematics Education and Application*, *4*(1), 1-8. https://doi.org/10.29303/griya.v4i1.420

Ramli, I. S., Maat, S. M., & Khalid, F. (2023). Learning mathematics in the new norms caused by digital game-based learning and learning analytics. *Pegem Journal of Education and Instruction, 13*(1), 168–176. https://doi.org/10.47750/pegegog.13.01.19

Rapanta, C., & Felton, M. K. (2022). Learning to Argue Through Dialogue: a Review of Instructional Approaches. *Educational Psychology Review, 34*, 477–509. https://doi.org/10.1007/s10648-021-09637-2

Rodríguez-Silva, C., Cuevas, J. C., & Violant-Holz, V. (2025). Fostering Creativity Through Educational Interventions in Higher Education: A Systematic Review. *The Journal of Creative Behavio, 60*(1), 1-58. https://doi.org/10.1002/jocb.70078

Simanjuntak, S. D., Fauzi, K. M., Mukhtar, & Sitepu, I. (2024). Transformation of Mathematics Learning Through a Combination of Gamification and Ethnomathematics Approach. *Electronic Journal of Education, Social Economics and Technology, 5*(2), 322-328. https://doi.org/10.33122/ejeset.v5i2.165

Siregar, T., & Fauzan, A. (2025). Systematic Literature Review: The Relationship between the Realistic Mathematics Education (RME) Approach and Students' Mathematical Numeracy Skills. *Yerizon and Fauzan, Ahmad, Systematic Literature Review: The Relationship between the Realistic Mathematics Education (RME) Approach and Students' Mathematical Numeracy Skills*.

Susanti, R. M., Gunansyah, G., & Nasution. (2025). Integrating Local Culture into Mathematics Learning: Ethnomathematics Approach Using Udeng Pacul Gowang in Elementary Schools. *Journal of Innovation and Research in Primary Education, 4*(3), 947–957. https://doi.org/10.56916/jirpe.v4i3.1472

Tarteer, S., & Ismail, I. A. I. (2020). Investigating the possible reasons beyond students' low achievement in mathematics in the tawjihi exam: a case

study. *British Journal of Education*, *9*(1), 20-41. https://doi.org/10.1002/jocb.70078

Wutsqa, D. U., Nugroho, H., & Wulandari, S. Y. (2026). Integrating Ethnomathematics into Guided Inquiry Learning: Designing Culturally Responsive Mathematics Instruction to Support Students' Mathematical Reasoning, Connections, and Appreciation. *Journal of Honai Math, 9*(1), 585–610. https://doi.org/10.56916/ijarme.v1i1.xxx

Yadav, A. R., & Singh, C. K. (2026). An Exploration of Teaching Strategies That Promote Problem-Solving and Higher-Order Thinking Skills. *International Journal of Engineering Science & Humanities, 16*(1), 100-109.

Yanti, S. (2025). The Role of Ethnomathematics in Enhancing Contextual Mathematics Understanding Among Students. *nternational Journal of Humanity Advance, Business & Sciences (IJHABS), 2*(4), 321-330. https://doi.org/10.59971/ijhabs.v2i4.402