

Development of a Physical Education Learning Medium Based on the Traditional Game *Dam-Daman* to Strengthen Numeracy Literacy of Elementary School Students

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Abstract

Numeracy literacy is an essential competence that needs to be developed from the elementary school level. However, its integration into physical education remains limited. Traditional games can provide contextual learning experiences that connect physical activity with numerical reasoning, problem solving, and decision making. This study aimed to develop a Physical Education learning medium based on the traditional game *Dam-Daman* to strengthen elementary school students' numeracy literacy. The study employed a Research and Development approach using the ADDIE model, comprising analysis, design, development, implementation, and evaluation. The developed medium consisted of a game board, playing pieces, Movement Cards, Numeracy Cards, Challenge Cards, Literacy Cards, and a user guide. Validity was assessed using Aiken's V, while practicality was evaluated through teacher and student responses. Effectiveness was examined using pretest, posttest, N-Gain, and effect size. The results showed a mean Aiken's V of 0.85, indicating high validity, while practicality ranged from 93% to 97%. Numeracy literacy scores increased from a mean pretest score of 56.5 to 85.8. The N-Gain was 0.67, categorized as moderate, with an effect size of 1.38, indicating a large effect. These findings suggest that *Dam-Daman*-based learning media can integrate physical activity with numeracy-oriented learning in elementary school physical education.

Keywords: *Dam-daman*; Traditional games; Numeracy literacy; Physical education; Elementary school students.

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INTRODUCTION

Physical, sports, and health education (PJOK) in elementary schools is not only oriented towards the development of movement skills. PJOK learning can also be a space to develop cognitive, social, and decision-making skills (Atqoo, 2026). These characteristics make PJOK have the potential to support cross-competency learning. However, PJOK learning practices still often place physical activity as the main goal. The potential of physical activity as a context to develop cognitive

abilities has not always been optimally utilized (Erickson, Donofry, Sewell, Brown, & Stillman, 2022).

One of the cognitive abilities that needs to be developed since elementary school is numeracy literacy. Numeracy literacy is not limited to the ability to perform computational operations. This ability includes the use of mathematical concepts to understand information. Numeracy literacy is also related to the ability to interpret data (Rakhmawati & Mustadi, 2022). These abilities are needed when students face problems in daily life. Therefore, the development of numeracy literacy requires learning experiences that allow students to use mathematical knowledge in a meaningful context (Rahmah & Zulfadewina, 2025).

The urgency of strengthening numeracy literacy is increasingly evident from the mathematics achievements of Indonesian students in international assessments. PISA 2022 shows that Indonesia's mathematics score is at 366. This figure is far below the OECD average of 472 (OECD, 2023). Only 18% of Indonesian students reach Level 2 or higher (Ayu, Putri, Riyanto, & Koto, 2025). The data does not directly describe the numeracy skills of elementary school students. However, the findings show the importance of building numeracy skills early. Strengthening at the elementary school level can be an important part of the process.

The development of numeracy requires a learning approach that is not only oriented to procedural exercise. Students need to gain the opportunity to use numbers in contextual situations. They also need to compare information. They need to choose a solution strategy. They need to explain the reasons for a Decision (O'Neill, Gillic, & Kingston, 2023). A game-based approach can provide a learning situation with these characteristics (Sun, Kangas, & Ruokamo, 2024). Games allow students to interact with the rules, information, challenges, and consequences of a Decision (Videnovik, Bogdanova, & Trajkovik, 2024).

Previous research has shown that game-based learning has the potential to support various aspects of math learning. The impact is not only seen on cognitive abilities. Games can also increase students' motivation, interest, and engagement (Hui & Mahmud, 2023; Himmawan & Juandi, 2023). Studies on non-digital games have also shown positive potential for the math abilities of elementary school students (Noda et al., 2024). The findings suggest that games do not have to be technology-based to provide a meaningful learning experience. Simple games can also be designed as a learning environment that integrates cognitive and social activities (Shi, Wang, & Ding, 2022).

In the context of elementary school, traditional games have more specific potential. Traditional games contain rules, social interactions, physical activity, and decision-making (Nasrulloh, Hermawan, & Ihsan, 2024). The games also have a closeness to the cultural context of students. In PJOK learning, traditional games have been used to increase participation. The games are also related to character development and movement skills (Ruban, Radovenchyk, Semal, Bilohur, Chkhailo, & Dzhym, 2024; Fizi, Winarni, & Hartanto, 2023). Other findings suggest that traditional games can support the physical fitness of elementary school students (Zulnadila et al., 2024). Thus, traditional games have a relevant pedagogical basis to be developed in PJOK learning.

However, most of the research on traditional games in PJOK still focuses on physical and social aspects (Anjani, Ali, Saputra, & Anjanika, 2026). The focus includes participation, fitness, character, and movement skills. Meanwhile, research

on game-based learning in mathematics is more placed in mathematics learning. The relationship between traditional games, PJOK activities, and numeracy literacy has not been widely developed as a single learning experience. This condition shows that there is a research space that still needs to be studied further.

The game of *Dam-Daman* has characteristics that can be used to answer these needs. The game involves the position of the pieces, the rules of the game, the sequence of steps, strategies, and decision-making (Anugrah, Haryanto, & Suarilah, 2022). Each step requires attention to the condition of the game. Students also need to consider the possibility of their next action. These characteristics can be developed into learning situations that contain numeracy and problem-solving activities (Aziz, Kristina, & Hermansah, 2026). However, this potential needs to be translated through structured media design.

In this study, the *Dam-Daman* mechanism was developed into a PJOK learning medium which has several components. Movement Cards are used to integrate movement activities. Numeracy Cards are used to present numeracy problems in the context of games. Challenge Cards are used to encourage strategy and problem-solving. Literacy Cards are used to train understanding of information and instructions. The four components are designed as a unit. The integration is expected to make physical activity and cognitive activity take place in the same learning experience.

The approach differs from the use of traditional games as a purely physical activity. Games are not only used to increase student engagement. Games are also designed as an environment to use numerical information. Students do not just perform movements. Students also read instructions. They solve problems. They consider choices. They make decisions based on the available information. Thus, the mechanics of games become part of the learning process.

However, previous research has not provided an adequate picture of the development of traditional game-based PJOK media that specifically places numeracy literacy as the main cognitive output. Research on traditional games has shown benefits on movement skills, fitness, character, and participation. Research on game-based learning has also shown benefits for mathematics learning. However, the integration of these two approaches in the context of elementary school PJOK still has room for development. This gap is the basis for the development of *Dam-Daman* media in this study.

The novelty of this research lies in the reconstruction of traditional game mechanisms into learning media that integrate physical activity and cognitive tasks. The novelty does not only lie in the use of *Dam-Daman*. Its innovative value lies in the way game mechanisms are connected to numeracy literacy. Media is designed to connect movement, information, strategies, and problem solving. Thus, traditional games are positioned as a context of cross-competency learning. This position expands the use of traditional games in elementary school PJOK learning.

Conceptually, this study places PJOK as a learning environment that can support cognitive development. Physical activity is not positioned separately from the thought process. Game activities become a context for students to use numerical information. Game strategies become a context for decision-making. Game challenges become a context for problem solving. These integrations become the basis for developing a more contextual and active learning experience.

Based on these gaps, this study aims to develop PJOK learning media based on traditional *Dam-Daman* games to support the strengthening of numeracy literacy of elementary school students. This study specifically examines the characteristics of the developed media. The research also examines the validity and practicality of the media. Furthermore, the study evaluates the change in students' numeracy literacy abilities after using the media. The results of the study are expected to contribute to the development of PJOK learning media that integrates physical activities, traditional games, and strengthening numeracy competence.

RESEARCH METHOD

This research uses a Research and Development (R&D) approach with the ADDIE model which includes *analysis*, *design*, *development*, *implementation*, and *evaluation*. This model was chosen because it is suitable for developing, validating, implementing, and evaluating PJOK learning media (Li & Cheong, 2023). Media development is directed to integrate physical activity, numeracy literacy, problem-solving, and decision-making through traditional *Dam-Daman* games.

The stages of the research are presented in Table 1.

Table 1. Stages of Media Development

Stages	Activities
Analysis	Identify PJOK learning needs, student characteristics, media needs, and numeracy literacy needs through interviews, observations, and questionnaires.
Design	Designing game boards, pieces, game rules, card systems, game flows, assessments, and research instruments.
Development	Develop prototypes, conduct expert validation, analyze validation results, and revise products.
Implementation	Using media in learning PJOK through the game of Checkers and activities on each card.
Evaluation	Evaluate the validity, practicality, and changes in students' numeracy literacy skills.

The media developed consists of game boards, pieces, Movement Cards, Numeracy Cards, Challenge Cards, Literacy Cards, and user guides. Movement Cards are used to integrate physical activities. Numeracy Cards provide a numerical stimulus. Challenge Cards develop strategies and problem-solving. Literacy Cards present information and instructions that students must understand.

The research instruments include expert validation sheets, teacher and student practicality questionnaires, and numeracy literacy tests. Validation includes aspects of PJOK material, media design, numeracy literacy, and language. Practicality is assessed based on ease of use, clarity of rules, attractiveness, timeliness, implementation of activities, and media usefulness. The numeracy literacy test includes numbers and operations, problem solving, reasoning and information analysis, and decision-making based on numerical information.

Table 2. Research Instruments

Instruments	Measured Aspects	Data
Expert validation	Materials, media, numeracy, language	Aiken's V

Teacher and student questionnaire	Convenience, appeal, practicality, benefits	Percentage
Numeracy test	Numbers, problem-solving, reasoning, decisions	Pretest– Posttest

Product validity was analyzed using Aiken's V. Values of $V \geq 0.80$ were categorized as very valid, $0.60 < 0.80$ valid, $0.40 < 0.60$ were valid, and < 0.40 were invalid. Practicality was analyzed using the percentage of response scores. The percentage of 81%–100% was categorized as very practical. Effectiveness was analyzed through a comparison of pretest and posttest scores. Ability increase was calculated using N-Gain, while the magnitude of change was analyzed using effect size.

Effectiveness analysis was carried out in each domain of numeracy literacy. The results of the analysis are presented in Table 3.

Table 3. Results of Numeracy Literacy Analysis

Domain	Pretest	Posttest	N-Gain	Effect Size
Number and operation	58	88	0,71	1,45
Troubleshooting	55	84	0,64	1,30
Information reasoning and analysis	56	85	0,66	1,22
Decision-making	57	86	0,67	1,28
Total	56,5	85,8	0,67	1,38

Based on the available data, the average score of numeracy literacy increased from 56.5 to 85.8. N-Gain of 0.67 was in the medium category. Effect size of 1.38 indicated a large effect. Validity and practicality data were used to complete the evaluation of product quality before the interpretation of effectiveness was carried out.

RESULTS AND DISCUSSION

Needs Analysis

The needs analysis shows that PJOK learning at the research site still relies heavily on the use of textbooks and routine exercises. This pattern causes a limited variety of students' learning experiences. Learning has not optimally utilized games as an active learning environment. This condition is becoming increasingly important because around 82% of students are reported to rarely gain learning experience through games. On the teacher's side, it was found that there is no media that specifically combines movement activities with numeracy exercises.

These findings show that there is a gap between the learning characteristics of PJOK and the need for developing students' cognitive competencies. PJOK has characteristics that allow students to learn through hands-on activities. Students can move, interact, follow rules, and make decisions. However, this potential has not been fully directed to provide numeracy experiences. These needs then became the basis for the development of media that does not separate physical activity from cognitive activity.

This problem also shows that the development of media is not enough to produce interesting games. The media needs to have a clear pedagogical function.

Every activity in the game must have a relationship with the learning objectives. On this basis, the traditional game of *Dam-Daman* was chosen as the framework of the game. This selection is based on the existence of rules, the position of the pieces, the sequence of steps, strategies, and decision-making that can be developed into a learning situation.

Characteristics of Developed Media

The developed media consists of game boards, pieces, Movement Cards, Numeracy Cards, Challenge Cards, Literacy Cards, and user guides. These components are designed as a single learning system. Each component has a different function, but they all work in the same game mechanics.

Table 4. Media Components and Learning Functions

Components	Main Functions
Movement Cards	Integrate motion activities in the game
Numeracy Cards	Provide stimulus and numeracy tasks
Challenge Cards	Drive strategy, problem-solving, and decision-making
Literacy Cards	Practice comprehension of information and instructions
Game boards and pieces	Become the main structure of interaction and game strategy
Usage Guide	Directing media implementation procedures

These characteristics indicate that *Dam-Daman* is not used as a traditional game conventionally. The game mechanics are reconstructed into a learning medium. Movements do not stand alone. Movements are linked to the rules of the game. Numeracy tasks are also not given as separate exercises. Tasks are placed in the context of the game. Strategy challenges are then used to encourage students to consider choices and consequences.

The design provides a different position for traditional games in PJOK learning. Previous research has shown that traditional games have been widely associated with student participation, character, movement skills, and fitness (Macar & Ziyagil, 2024; (Fauzi, Suherman, Saptani, Dinangsit, & Rahman, 2023; Hassani & Afazeli, 2024). The media developed in this study expands this function by including numeracy literacy as a cognitive goal.

Product Validity

The validation results showed that the developed media had a high level of validity. The average value of Aiken's V reached 0.85. The value was in the very valid category based on the criteria used in the study.

Table 6. Product Validation Results

Aspects Assessed	Aiken's V	Categories
PJOK Materials	0,87	Highly Valid
Media design	0,85	Highly Valid
Numeracy literacy	0,86	Highly Valid
Language	0,83	Highly Valid

Average	0,85	Highly Valid
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The highest score was obtained in the PJOK material aspect with a coefficient of 0.87. These results show that the substance of the media is assessed in accordance with the context of PJOK learning. The numeracy literacy aspect obtained a score of 0.86. These findings show that the integration of numeracy tasks in the media is seen as in accordance with the designed objectives. The media design obtained a score of 0.85. Meanwhile, the language aspect obtained a score of 0.83 and became the lowest score among the four aspects. Nevertheless, all aspects remain in the very valid category.

The validity is not only determined by the quantitative score. The validator also provides input to the product. The instructions on the card need to be simplified. The difficulty level of the task also needs to be adjusted. The input is then used in the revision process. This shows that the validation process serves as a mechanism for product refinement. Thus, Aiken's V value does not stand alone. The value needs to be read together with the revision process carried out after the expert assessment.

Media Practicality

The results of the practicality test showed that the media can be used in learning based on the responses of teachers and students. The teacher's response reached 95% on the small-scale test and increased to 97% on the field test. The student's response reached 93% on the small-scale test and increased to 96% on the field test.

Table 5. Results of Media Practicality

Respondents	Small-Scale Tests	Field Test
Teacher	95%	97%
Students	93%	96%
Average	94%	96,5%

The average practicality increased from 94% in small-scale tests to 96.5% in field tests. Both results are in the very practical category. Practicality aspects include ease of use, clarity of rules, attractiveness, timeliness, implementation of activities, and usefulness of media.

The increased response to field tests indicates that the media can be applied better after going through the development and revision process. This finding is important because it is not enough to be only valid in terms of content. The media must also be able to be used by teachers and students in real learning conditions. Thus, validity and practicality are two aspects that complement each other in assessing product quality.

The high response rate can also be understood from media characters that combine play activities with learning activities. Games provide a more active interaction structure. Students follow rules. Students use cards. Students move. Students also face challenges. These characters are in line with research on game-based learning that shows that games can support student engagement, motivation, and cognitive aspects (Nadeem, Oroszlanyova, & Farag, 2023)

The Effectiveness of Media on Numeracy Literacy

The effectiveness of the media was analyzed based on changes in numeracy literacy skills before and after the use of media. The results showed that the average score increased from 56.5 in the pretest to 85.8 in the posttest. Thus, there was a considerable change in score after the implementation of the media.

The overall N-Gain value reached 0.67. Based on the criteria used, the value was in the medium category. Meanwhile, the effect size reached 1.38 and was in the large category. The findings showed that the change in score was not only descriptive, but also showed a large magnitude of change based on the effect size.

Table 6. Media Effectiveness Results Based on Numeracy Literacy Domain

Domain	Pretest	Posttest	N-Gain	Effect Size
Number and operation	58	88	0,71	1,45
Troubleshooting	55	84	0,64	1,30
Information reasoning and analysis	56	85	0,66	1,22
Numeracy-based decision-making	57	86	0,67	1,28
Total numeracy literacy	56,5	85,8	0,67	1,38

The increase occurred in all domains measured. Number domains and operations increased from 58 to 88. N-Gain reached 0.71. Effect size reached 1.45. This result was the highest N-Gain and effect size among all domains. This finding can be attributed to the existence of Numeracy Cards that provide numerical stimulus directly in game activity.

The problem-solving domain increased from 55 to 84. The N-Gain reached 0.64. The effect size reached 1.30. This increase can be attributed to Challenge Cards that provide situations that require strategy and problem-solving. In the context of *Dam-Daman*, students do not just execute the rules. They also need to consider the possible steps and consequences of the choices made.

The domain of reasoning and information analysis increased from 56 to 85. N-Gain reached 0.66. Effect size reached 1.22. These results showed a change in abilities related to information processing. Literacy Cards are one of the components that provide context for the process. Students need to read the information and understand the instructions before responding to the game situation.

The number-based decision-making domain increased from 57 to 86. N-Gain reached 0.67. Effect size reached 1.28. These results show that strategic activities in games can be a context for decision-making. Students need to pay attention to the position of the pieces, rules, possible movements, and game situations before deciding on an action.

Why can the Media Support Numerical Literacy?

The increase in scores across domains shows that media provides a learning experience that is not only oriented towards physical activity. The game mechanics create situations that require students to perform several processes in sequence. Students read information. Students understand the rules. Students perform activities. Students use numerical information. Students consider choices. Students then make decisions.

This series is important because numeracy literacy is not only related to numeracy skills. Numeracy literacy is also related to the use of mathematical information in certain situations. The ability to understand quantitative situations, use information, and choose strategies as important parts of mathematical competence (Schulz, 2024). *Dam-Daman* media provides a simple context to present this process in learning.

The contribution of Numeracy Cards is most evident in the domain of numbers and operations. Numeracy tasks are placed directly in the game. Students get the opportunity to use numbers and operations in situations that are not completely separate from the play activity (Bakar, 2025). This condition is different from numeracy exercises which are only in the form of written questions.

Challenge Cards provide different functions. They connect the game to problem-solving and strategy. The game situation makes students need to consider alternatives. They are not just looking for answers. They also need to determine the actions that are considered appropriate. This provides a context for the development of problem solving and decision making skills (Vazquez-Calatayud, Garcia-Garcia, Regaira-Martinez, & Gómez-Urquiza, 2024).

Literacy Cards then complete the process. Students need to understand information before taking action. Thus, the numeracy process does not stand alone (Geiger & Schmid, 2024). Numeracy is connected to the ability to read information (Pratiwi, Murtafiah, & Rakhmad, 2025). This relationship strengthens the character of media as a cross-competency learning medium.

Integration of PJOK and Numeracy Literacy

The findings of the study show that PJOK activities can be used as an environment to develop cognitive abilities. This position is important because PJOK learning is often understood primarily through movement skills. In fact, game activities also involve attention, strategy, interaction, and decision-making.

In *Dam-Daman* media, physical activities are placed through Movement Cards. These activities maintain the media's identity as PJOK media. At the same time, Numeracy Cards, Challenge Cards, and Literacy Cards provide a cognitive dimension. These four components form an integrated learning experience.

These findings expand on the results of previous research on traditional games. Previous research has shown many benefits of traditional games on participation, character, movement skills, and fitness (Aliriad, Adi, Manullang, Endrawan, & Satria, 2024; Ospankulov, Zhumabayeva, & Nurgaliyeva, 2023). Meanwhile, game-based learning research shows the potential of games in supporting mathematical skills and learning engagement (Debrenti, 2024). This study brings together the two domains through media that places traditional games as a context for numeracy learning in PJOK.

Research Contributions and Novelties

The main contribution of the research lies in the reconstruction of the *Dam-Daman* game into a learning medium that has a structured pedagogical function. Traditional games are not only maintained as cultural activities. The mechanism is used to create learning situations. Movement, numeracy, literacy, strategy, and decision-making are placed in one game experience.

This novelty is also seen in the position of numeracy literacy as the main cognitive output in PJOK media. Previous research on traditional games in PJOK has highlighted more physical, social, and character aspects. On the other hand, game-based learning for mathematics is more often placed in the context of mathematics learning. Media *Dam-Daman* in this study tries to connect the two spaces.

Thus, the contribution of research does not solely lie in the use of traditional games. Its contribution lies in pedagogical design that transforms game mechanics into means of learning. This provides an opportunity to expand the function of traditional games as a cross-competency learning medium in elementary schools.

Interpretation of Effectiveness and Limitations

Although the increase in numeracy literacy scores is quite obvious, the effectiveness results must be interpreted carefully. The average score increased from 56.5 to 85.8. N-Gain reached 0.67. Effect size reached 1.38. The data showed a positive change after media use.

However, the design of one pretest-posttest group has limitations in explaining the cause-and-effect relationship. The absence of a control group causes a change in scores that cannot be completely separated from other factors. These factors can be previous learning experiences, measurement effects, student development, or learning effects during the study.

Therefore, the research findings are more appropriately understood as preliminary evidence of the potential of *Dam-Daman* media in supporting numeracy literacy. Stronger conclusions about causal effectiveness require further research with a comparison group. Subsequent studies may also use a more diverse sample and a longer implementation period.

Overall, the results showed a consistent relationship between product quality and changes in learning outcomes. The media obtained an average validity of 0.85. Practicality reached 94% in small-scale tests and 96.5% in field tests. Numeracy literacy ability increased from an average of 56.5 to 85.8. N-Gain reached 0.67. Effect size reached 1.38.

The series of findings show that *Dam-Daman* media has three main strengths. First, the media has high validity. Second, the media has a very high level of practicality. Third, the use of media is followed by an increase in numeracy literacy skills. The three findings strengthen the position of traditional games as an alternative learning media that can link physical activity with cognitive development.

However, the research contribution still needs to be placed within its methodological limits. The results obtained are not enough to state that the *Dam-Daman* media is more effective than other learning approaches. The research findings provide an empirical basis that traditional game designs can be used to present numeracy learning experiences in PJOK. The evidence can be the basis for further research with stronger experimental designs.

CONCLUSION

This research shows that the development of traditional game-based PJOK learning media can be an alternative approach to expand the function of play in the

educational process. *Dam-Daman* is not only placed as a play activity or a means of developing movement skills. Through the reconstruction of the game mechanism, physical activity can be combined with the process of reading information, using numerical knowledge, solving problems, and making decisions. The integration provides a more contextual learning experience as students are faced with cognitive tasks in active and meaningful game situations.

The main contribution of this research lies in the learning design that brings together the characteristics of PJOK with the need to strengthen numeracy literacy. Each media component has a complementary function in building an integrated learning experience. This approach expands the use of traditional games from physical and social contexts to cognitive learning contexts. Practically, the media developed can be an alternative for teachers to present PJOK learning that is more varied, active, and integrated with cross-field competencies. Conceptually, this research reinforces the idea that physical activities can be used as a context to build learning experiences that involve thinking processes.

However, the application of this media needs to consider the characteristics of students, teacher readiness, classroom management, and the learning context in which the media is used. The findings of the study also cannot be used to make broad generalizations about the cause-and-effect relationship because the evaluation design used has not yet involved a comparison group. Further research needs to test the media through a quasi-experimental or experimental design with a control group, involving more diverse characteristics of the school and students, and using a longer implementation period. Further studies are also needed to determine the sustainability of media use and the contribution of each game component to the development of numeracy literacy. In this direction, the development of traditional games can move from simply preserving cultural activities to pedagogical innovations based on the context, competence, and learning needs of elementary school students.

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REFERENCES

- Aliriad, H., Adi, S., Manullang, J. G., Endrawan, I. B., & Satria, M. H. (2024). Improvement of motor skills and motivation to learn physical education through the use of traditional games. *Physical Education Theory and Methodology*, 24(1), 32-40. <https://doi.org/10.17309/tmf.v2024.1.04>
- Anjani, R., Ali, M., Saputra, A., & Anjanika, Y. (2026). The Influence Of Traditional Games On The Integrity Character Of Junior High School Students. *COMPETITOR: Jurnal Pendidikan Keahlian Olahraga*, 18(1), 1829-1842. <https://doi.org/10.26858/cpjok.v18i1.697>

- Anugrah, W., Haryanto, J., & Suarilah, I. (2022). Effect of Traditional Game Dam-Daman to Decrease Level of Dementia on Elderly. *Lux Mensana: Journal of Scientific Health*, 75-85.
- Atqoo, R. A. (2026). Evaluation Of Basketball Course Learning Outcomes Reviewed From Student Skills and Knowledge Tests PJOK. *Jurnal Speed (Sport, Physical Education, Empowerment)*, 9(01 Mei), 1-9.
- Ayu, G. N., Putri, C. A., Riyanto, A. R., & Koto, I. (2025). The scientific literacy competence of students in Indonesia and Mexico based on PISA 2022: An international comparative study. *TOFEDU: The Future of Education Journal*, 4(5), 1033-1038. <https://doi.org/10.61445/tofedu.v4i5.525>
- Aziz, A., Kristina, P. C., & Hermansah, B. (2026). Development of a Traditional Dam-Daman Game Based Physical Education Model to Enhance Learning Motivation among Junior High School Students in Musi Rawas, Indonesia. *Jurnal Porkes*, 9(2), 1056-1073. <https://doi.org/10.29408/porkes.v9i2.34023>
- Bakar, K. A. (2025). Game-Based Learning in the Teaching and Learning of Mathematics Through Number Operations at the Preschool Level. *FAKULTI PENDIDIKAN UNIVERSITI KEBANGSAAN MALAYSIA*, 55.
- Fauzi, R. A., Suherman, A., Saptani, E., Dinangsit, D., & Rahman, A. A. (2023). The impact of traditional games on fundamental motor skills and participation in elementary school students. *International Journal of Human Movement and Sports Sciences*, 11(6), 1368-1375.
- Debrenti, E. (2024, March). Game-Based Learning experiences in primary mathematics education. In *Frontiers in Education* (Vol. 9, p. 1331312). Frontiers.
- Fizi, R. M., Winarni, S., & Hartanto, A. (2023). A game model in physical education to improve motor skills, cooperation, and discipline of primary school learners. *Pedagogy of Physical Culture and Sports*, 27(6), 448-455.
- Li, H., & Cheong, J. P. G. (2023). Using the ADDIE model to design and develop physical education lessons incorporated with a functional training component. *Frontiers in Public Health*, 11, 1201228. <https://doi.org/10.3389/fpubh.2023.1201228>
- Hassani, F., & Afazeli, Z. (2024). Be More Active with Traditional Games: Traditional Review. *Turkiye Klinikleri Journal of Sports Sciences*, 16(1), 119.
- Himmawan, D. F., & Juandi, D. (2023). Games based learning in mathematics education: A systematic literature review. *UNION: Jurnal Ilmiah Pendidikan Matematika*, 11(1), 41-50. <https://doi.org/10.30738/union.v11i1.13982>
- 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, 1105806. <https://doi.org/10.3389/fpsyg.2023.1105806>
- Macar, Ş., & Ziyagil, M. A. (2024). the Effect of Traditional Games Education on Physical Fitness, Health and Happiness Levels in Secondary School Students. *Conhecimento & Diversidade*, 16(43), 452-481. <https://doi.org/10.18316/rcd.v16i43.11909>
- Nasrulloh, A., Hermawan, H. A., & Ihsan, F. (2024). Health benefits of traditional games: a systematic review. *Retos: nuevas tendencias en educación física, deporte y recreación*, (59), 843-856.

- Noda, S., Shimizu, K., et al. (2024). Non-digital games that promote mathematical learning in primary years students: A systematic review. *Education Sciences*, 14(2), 200. <https://doi.org/10.3390/educsci14020200>
- O'Neill, S., Gillic, C., & Kingston, M. (2023). Pedagogical strategies, approaches and methodologies to support numeracy in early childhood A review of the literature.
- Ospankulov, Y., Zhumabayeva, A., & Nurgaliyeva, S. (2023). The Impact of Folk Games on Primary School Students. *Journal of education and e-learning research*, 10(2), 125-131. <https://doi.org/10.20448/jeelr.v10i2.4473>
- Pratiwi, C. P., Murtafiah, W., & Rakhmad, R. (2025). The relationship between reading literacy and numeracy in solving story problems: Elementary school students. *Jurnal Eduscience*, 12(5), 1248-1258. <https://doi.org/10.36987/jes.v12i5.7569>
- Rakhmawati, Y., & Mustadi, A. (2022). The circumstances of literacy numeracy skill: Between notion and fact from elementary school students. *Jurnal Prima Edukasia*, 10(1), 9-18. <https://doi.org/10.21831/jpe.v10i1.36427>
- Ruban, A., Radovenchyk, A., Semal, N., Bilohur, V., Chkhailo, M., & Dzhyim, V. (2024). Sports games in the context of developing children's coordination ability as a component of physical development. *Revista Romaneasca pentru Educatie Multidimensionala*, 16(3), 415-429. <https://doi.org/10.18662/rrem/16.3/901>
- Shi, A., Wang, Y., & Ding, N. (2022). The effect of game-based immersive virtual reality learning environment on learning outcomes: designing an intrinsic integrated educational game for pre-class learning. *Interactive Learning Environments*, 30(4), 721-734. <https://doi.org/10.1080/10494820.2019.1681467>
- Sun, L., Kangas, M., & Ruokamo, H. (2024). Game-based features in intelligent game-based learning environments: A systematic literature review. *Interactive Learning Environments*, 32(7), 3431-3447. <https://doi.org/10.1080/10494820.2023.2179638>
- Vazquez-Calatayud, M., Garcia-Garcia, R., Regaira-Martinez, E., & Gómez-Urquiza, J. (2024). Real-world and game-based learning to enhance decision-making. *Nurse Education Today*, 140, 106276. <https://doi.org/10.1016/j.nedt.2024.106276>
- Videnovik, M., Bogdanova, A. M., & Trajkovik, V. (2024). Game-based learning approach in computer science in primary education: A systematic review. *Entertainment Computing*, 48, 100616. <https://doi.org/10.1016/j.entcom.2023.100616>
- Zulnadila, Z., Suharjana, S., Arjuna, F., Sriwahyuniati, C. F., Mappanyukki, A. A., Rahman, A., Agustina, D., & Szczepocki, M. (2024). Traditional games for physical fitness in primary school students: A systematic review in Indonesia. *Tanjungpura Journal of Coaching Research*, 3(2). <https://doi.org/10.26418/tajor.v3i2.89690>