Indonesian Journal of Education & Mathematical Science
Vol. 7, No. 3, September 2026, pp. 329~338
ISSN: 2715-985X, DOI: 10.30596/ijems.v7i3.30770

AI-Assisted Ethnomathematics Gamification through Traditional Stilt Games for Geometry Learning in Elementary Education

Tasya Fortuna Aurora[1], Beti Istanti Suwandayani[2]
[1.2] Faculty of Teacher Training and Education, Universitas Muhammadiyah Malang, Malang, Indonesia
beti@umm.ac.id

ABSTRACT

This study developed and evaluated an artificial intelligence-assisted ethnomathematics learning model that integrates the traditional stilt game into elementary geometry instruction. Using a Research and Development (R&D) approach with the 4D model (Define, Design, Develop, and Disseminate), the study involved 38 elementary students and 7 mathematics teachers in Indonesia. The learning media combined kinesthetic activities, local cultural contexts, and Google Teachable Machine to support meaningful geometry learning. Data were collected through observations, expert validation, questionnaires, interviews, and pre-test–post-test assessments. Quantitative data were analyzed using descriptive statistics and normalized gain (N-Gain), while qualitative data were examined through thematic analysis. The developed media demonstrated high feasibility, obtaining a validity score of 89.4% and a practicality score of 91.2%. Students' geometry achievement improved markedly, with mean scores increasing from 61.8 to 83.5 after implementation. The integration of physical movement and AI-based pose recognition promoted active participation, collaboration, and deeper conceptual understanding, while the use of traditional games enhanced students' cultural awareness and learning engagement. These findings indicate that combining ethnomathematics, gamification, and AI technology provides an effective and culturally responsive approach to elementary mathematics instruction, offering a practical contribution to the development of innovative learning models that improve conceptual understanding, motivation, and classroom engagement. **Keywords: gamification, Teachable Machine, geometry learning, elementary school, traditional games**

Corresponding Author:
Beti Istanti Suwandayani
Primary School Teacher Education Department
Faculty of Teacher Training and Education
Muhammadiyah University of Malang, Indonesia
Tlogomas Highway 246 Malang
beti@umm.ac.id

1. INTRODUCTION

Learning mathematics directed to form ability think systematic, logical and creative basis, as well as develop skills collaborative student (Jannah et al., 2024). In context education school basic, learning mathematics own role important in practice ability thinking and solving problem participant educate.(Suaib & Sutriyani, 2024) show that performance Study mathematics in chapter geometry Still many have not reach Criteria Minimum Completion Criteria (KKM). This happen Because learning conventional dominated method lecture Still often applied in class, so that participant educate tend feel fed up Because lack of involvement active in learning (Yuniarti et al., 2023). Teachers' limited ability to design instructional media that meet students' needs remains one of the challenges in mathematics learning at the elementary school level (Nurfadilah et al., 2026). In addition, students also have difficulty understand draft base geometry, such as angles, lines, symmetry, planes, and space, as well as difficulty connect connection between get up geometry (Nu'man & Azka, 2023). Problems This the more complicated Because amount formula geometry that must be memorized student the more many, so that mathematics often considered as difficult and less lessons interesting (Rosilawati et al., 2024).

Use game traditional in teaching mathematics own role important in repair understanding concept, improve involvement active, add motivation learning, and strengthen interaction social among students (Nur, 2025). Study Hanan & Alim (2023) show that with use game simple in the learning process, students can more easily understand draft geometry and also easier remember various formula mathematics. In context this game traditional own potential big For utilized as a relevant learning medium with life students. In addition to helping understand concept, game traditional also has values like religious, feeling of love homeland, ability independent, work same, and honesty the one that can help formation attitude and character (Sholikin et al., 2022). Collaborative learning provides opportunities for students to participate actively, share responsibilities, and develop cooperation skills

through group activities (Intan Rahayu et al., 2026).This is appropriate with opinion that school base is stage important in form character child since beginning (Suyitno & Setiawan, 2021). Development theory Vygotsky's social explanation that interaction between fellow humans is very important in development thinking children, so that play together Can become method excellent learning (Smolucha & Smolucha, 2021).

Study previously Already try create learning media that uses game traditional. One of the for example is development of board game - based media One of the games for example is development of board game - based media game traditional stilts coconut shell, with design similar games with ludo, which is used as tool learning in class (Maryanti et al., 2021). Although the study demonstrated the potential of traditional games to support mathematics learning, the developed media was still limited to conventional game-based activities and did not integrate emerging digital technologies to enrich the learning process. As a result, opportunities to provide more interactive learning experiences and immediate feedback for students were still limited. The rapid development of artificial intelligence offers an opportunity to address these limitations by supporting more adaptive and interactive learning through automatic activity recognition and real-time feedback. Therefore, this study combines the traditional stilt game with artificial intelligence using Teachable Machine to enhance students' engagement and conceptual understanding while preserving the educational and cultural values of traditional games. Aliya et al. (2025) disclose that utilization technology intelligence artificial in learning capable increase efficiency, personalization, quality of the learning process, and intelligence artificial can help educator in understand characteristics Study participant educate as well as give bait more back right. The use of technology in learning can increase students' attention, motivation, and participation by providing more interactive learning experiences (Azizah et al., 2025). Although so, no studies have integrated traditional games with artificial intelligence in elementary mathematics learning. Traditional games provide meaningful learning experiences by promoting physical activity, social interaction, and the integration of local cultural values. However, their educational potential can be further enhanced through the use of artificial intelligence, which enables more interactive learning experiences and supports real-time feedback during learning activities. The integration of AI also allows students' movements during gameplay to be directly connected with mathematical concepts, making abstract geometric ideas more concrete and easier to understand. Therefore, combining traditional games with artificial intelligence not only preserves local cultural heritage but also enriches mathematics learning through a more interactive and contextual approach. Rapid development technology also has the potential cause fading culture local Because participant educate tend more interested in modern technology (Muarifin & Zainal, 2024). Conservation efforts culture area needs implanted start since child age Elementary (Oktaviasary & Sutini, 2024)

Study about use of Teachable Machine in learning mathematics at the level school base Still Not yet Lots (Kurz et al., 2024) On the other hand, progress technology intelligence artificial give chance new to innovate in method study. One of the technologies that can used is Teachable Machine, which is a platform that allows users training learning models machine without need Can write code. With Thus, people who do not own background behind programming is also possibly understand draft intelligence artificial in a way easy (Prasad et al., 2022). Technology This own potential to support more learning interactive as well as make it easier student in visualize concepts abstract mathematics. Research previously has developing media based on game traditional and technology intelligence artificial in a way separate. However, not yet Lots integrated research game traditional based culture local with artificial intelligence technology in learning geometry school basic. In addition, the use of Teachable Machine in context learning mathematics based kinesthetic still very limited

Apart from using results study previously, research this is also based on observation the beginning of what was done towards teachers and students at school basis. Survey results against 38 students' classes IV–VI show that 47.4% of student Not yet Once learn mathematics through game traditional. However, most student show interest in methods more learning innovative. As many as 76.3% of students say want to Study mathematics with method different from usually, while 63.1% of students interested in learning by using game traditional. In addition, 60.5% of student expressed great interest If learning use technology such as a cell phone or laptop. Answer open student show that difficulty main in Study mathematics related with memorize formula and understanding question story. Observation results against 7 school teachers base show that 57.1% of teachers said that student Still

Indonesian Journal of Education & Mathematical Science
Vol. 7, No. 3, September 2026, pp. 329~338
ISSN: 2715-985X, DOI: 10.30596/ijems.v7i3.30770

experience difficulty in understand material geometry and measurement. In addition, all teachers who answered state that Spirit Study student to material the Still lacking and necessary creativity in combined learning game as well as technology. New study This lies in integration game traditional stilts with Teachable Machine technology based on pose recognition for create learning interactive, contextual, and object - based geometry activity physique.

Based on condition mentioned, there are difference between learning mathematics as it should be nature interactive, contextual, and utilize technology with condition real in the field which is still dominated by methods conventional. Therefore, it is needed innovation in a combined learning process culture local with digital technology so that the concept complicated mathematics Can understood with more clear and real. Innovation in study This is development of learning prototypes which use gamification, namely combine game traditional stilts with Teachable Machine Learning technology. This research combines approach ethnomathematics local with machine learning technology to create experience learn more interactive and contextual in the material geometry in school basic.

2. RESEARCH METHOD

This study employed a Research and Development (R&D) approach using the 4D development model proposed by Thiagarajan, Semmel, and Semmel, which consists of four stages: Define, Design, Develop, and Design.

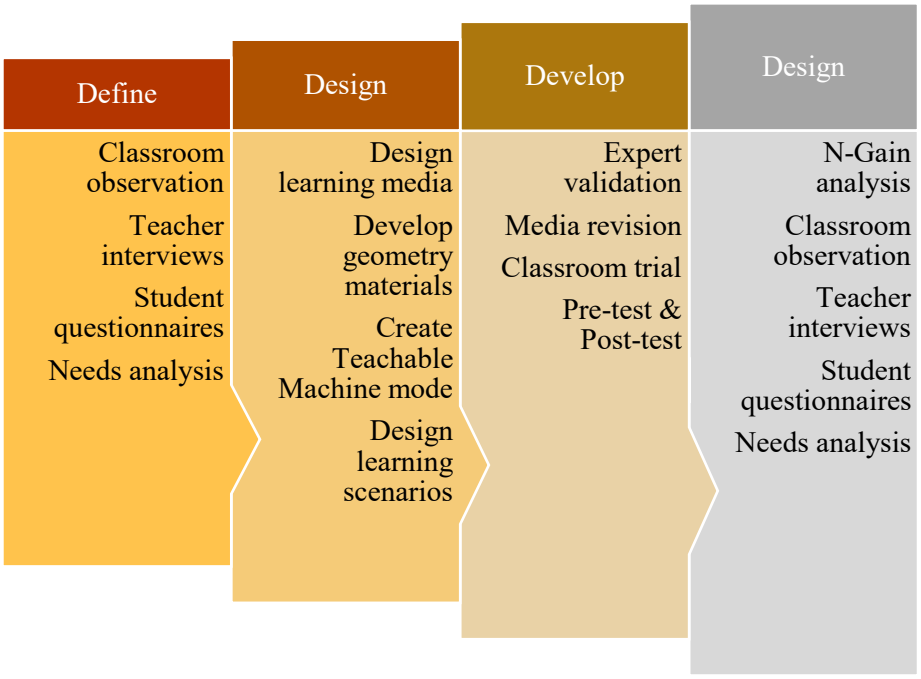

Fig 1. Research procedure based on the 4D development model

The research aimed to develop a gamification-based learning media integrating traditional stilt games with Teachable Machine technology for geometry learning in elementary schools. The study involved 38 elementary school students from grades IV–V and 7 elementary school teachers. The participants were selected using purposive sampling based on the consideration that students had previously studied basic geometry concepts and experienced difficulties in understanding abstract geometric materials. The teachers involved had experience teaching mathematics at the elementary school level. The define stage aims to identify learning problems and analyze students' needs related to geometry learning. Data collection was conducted through classroom observations, interviews with teachers, and questionnaires distributed to students. The analysis focused on identifying students' difficulties in understanding geometric concepts, learning motivation, and the need for interactive learning media integrating physical activities and technology.

The results of the preliminary analysis indicated that geometry learning was still dominated by conventional lecture methods, causing students to experience difficulties in understanding abstract

concepts such as angles, lines, and geometric shapes. Students also showed high interest in learning activities involving games and digital technology. At the Design stage, the prototype of gamified learning media was designed by integrating traditional stilt games with Teachable Machine technology. The learning activities were developed using kinesthetic approaches through body movements and hand poses representing geometry concepts.

Students' hand poses were used as input data for Teachable Machine training. Each pose represented specific geometric concepts, such as angles and geometric patterns. The collected visual datasets were categorized and trained using the Teachable Machine platform to develop an image recognition model capable of detecting students' movements in real time. The media design also included learning scenarios, instructional flow, game rules, and visual feedback mechanisms generated by the system to support interactive learning experiences.

At the Develop stage, the prototype was validated by two experts consisting of a mathematics education expert and an instructional media expert. The validation process aims to assess the feasibility of the developed media in terms of content suitability, instructional quality, usability, visual communication, and interactivity. The validation instrument used a Likert scale ranging from 1 to 5. The validation score was calculated using the following formula:

$$Validity\ Percentage = \frac{Obtained\ Score}{Maximum\ Score} x100\%$$

After revision based on expert suggestions, the media prototype was implemented through limited trials involving elementary school students. The trial aimed to evaluate practicality, student responses, and learning effectiveness. The Disseminate stage was conducted on a limited scale by introducing the developed media to teachers and students. At this stage, questionnaires were distributed to evaluate students' responses toward the implementation of the learning media. The dissemination process also aims to identify the strengths and limitations of the developed prototype as an initial evaluation for further development.

Quantitative data obtained from validation sheets, questionnaires, and learning outcome tests were analyzed descriptively using percentages and normalized gain (N-Gain) analysis. To evaluate the effectiveness of the developed learning media, the normalized gain (N-Gain) analysis was conducted based on student's pre-test and post-test scores. The N-Gain analysis was used to determine the magnitude of students learning improvement after the implementation of the developed learning media. The N-Gain formula used was:

$$g = \frac{Posttest\ Score\ -\ Pretest\ Score}{Maximum\ Score\ -\ Pretest\ Score}$$

Qualitative data obtained from observations and interviews were analyzed using the interactive model of Miles and Huberman consisting of data collection, data reduction, data display, and conclusion drawing. The combination of quantitative and qualitative analyzes was intended to provide comprehensive findings regarding the feasibility and effectiveness of the developed learning media.

3. RESULTS AND DISCUSSION

A. Define

Data collection at the stage analysis need done through questionnaires given to student For get description about experience learning, level understanding to material geometry, as well as interest they to use method more varied. Nursalam & Djaha (2023) learning questionnaire is instrument main in research data collection that produces numerical data For analyzed in a way statistics. The goal is get relevant, valid, and reliable information. Sugiyono (2023) researchers compile questionnaire as instrument data collection. Before used, questionnaire moreover formerly tested For ensure validity and reliability. Questionnaire arranged with a number of indicators that include habit Study students, difficulties faced in understand draft geometry, as well as interest to learning based activities and

Indonesian Journal of Education & Mathematical Science
Vol. 7, No. 3, September 2026, pp. 329~338
ISSN: 2715-985X, DOI: 10.30596/ijems.v7i3.30770

technology. The results obtained show that learning mathematics in progress Still tend dominated by methods lecture, so that involvement student in the learning process Still limited. Condition This impact on low understanding draft as well as lack of interest Study students, especially on material that is abstract like geometry In addition, some student state that they experience difficulty in understand connection between get up geometry and remembering the formula used. Students also show more interest tall to learning that involves activity direct and use technology. This is show existence need to more learning interactive, contextual, and capable connect draft mathematics with experience real student. Fatimah & Sari (2025) approach contextual in learning mathematics emphasize relatedness draft with life everyday so that students more easy understand and apply it. Activities filling questionnaire by students at the stage This can seen in Figure 2. Data obtained used as base in designing and developing more learning media in accordance with characteristics as well as need student school base .

Fig 2. Filling questionnaire by students

B. Design

Design learning This utilizing hand poses as a medium for represent draft angle to be more easy understood by students. In activity learning, students requested lift left hand with amount finger certain as symbol big angle, namely One finger For corner one, two fingers For angles two and three finger For corner three. Approach This in line with style Study kinesthetic, namely method learning that emphasizes use activity physique as means main For understand material optimally. Therefore Supit et al. (2023) that, the pose used designed in a way simple to easy imitated, not confusing, and appropriate with characteristics student school the basis that is still is at the stage Study concrete.

Every pose done by the student recorded as visual data later utilized as material training on the Teachable Machine syste. At this stage this, poses are grouped based on amount finger shown for the system can learn difference characteristics evey movement in a way systematic. Training process This aim For increase ability system in recognize poses right, though there is variation position or difference between students. After the model is successful formed, system can identify the pose shown student in a way directly and provide bait come back in accordance with category the angle that has been determined. Feed return given functioning as means evaluation for student For evaluate suitability movements performed with the concepts studied. With existence response direct from system, students pushed For try return until get correct results, so that the learning process become more active and recurring. Ariani et al. (2026)in evaluation learning, assessment own role important as means giving bait come back for teachers. Assessment formative no only used for measure results learning, but also becomes a medium for reflection in improve the learning process. Example hand pose representation along with results detection can seen in Figure 3.

To further evaluate the effectiveness of the developed learning media, students' learning outcomes were analyzed using pre-test and post-test assessments involving 38 elementary school students. The mean pre-test score was 61.8, indicating that students' initial understanding of geometry

concepts was still limited before implementation. After participating in the kinesthetic and AI-assisted learning activities, the average post-test score increased significantly to 83.5, demonstrating a substantial improvement in conceptual mastery. To quantify the magnitude of this improvement, a normalized gain (N-Gain) analysis was conducted. The N-Gain score obtained was 0.68, which falls into the medium category ($0.30<g<0.70$). This medium N-Gain score indicates that integrating traditional stilt games with Teachable Machine technology effectively bridges abstract geometric concepts with concrete physical movements, fostering real-time self-correction, high engagement, and meaningful conceptual understanding among students.

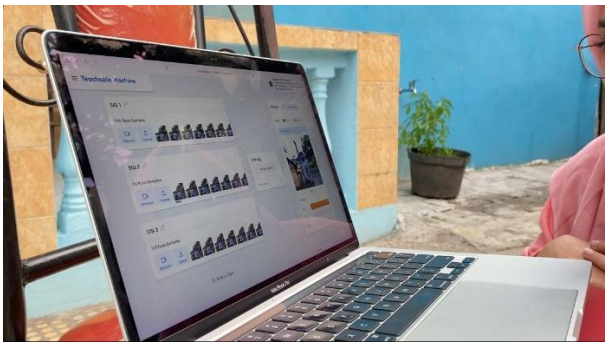

Fig 3. Design of Teachable Machine's pose detection

C. Develop

At the Develop stage, the prototype learning that has been designed Then implemented through trials limited to student grades IV–V of school basic in the environment around researchers. Trial done For see implementation learning, response students, as well as level understanding draft after media use. Activities learning designed in form activities that combine game traditional stilts with Teachable Machine technology so student can Study through experience directly. At the start of the activity, students introduced return with draft geometry that will studied, then to be continued with practice hand poses that have been designed at the stage previously. The pose used as representation draft corner, where students lift hand with amount finger certain in accordance categories that have been trained in system. Each pose displayed student Then detected by the Teachable Machine and generates bait visual feedback directly. This process help student understand relatedness between movements performed with draft geometry in question. Representation of student poses and results detection can seen in Figure 4.

Fig 4. Student pose detection using Teachable Machine

Next, students do activity play stilts For form pattern geometry through movement. Students directed For walk follow track certain so that forming lines and shapes flat like triangle. Activity This done in a way in groups, so that student can each other interact, work the same, and discuss concepts learned. Trial activities learning based stilts can seen in Figure 5. Via activity this, students No only understand form visually, but also experientially direct How draft geometry formed from movement.

Satriyo et al. (2026) the use of audio-visual media contributes significant in increase quality learning, because capable interesting attention students, clarify material that is abstract, and increase motivation and results study. Trial results show that student more active and enthusiastic during the learning process ongoing. Students seen more easy understand draft geometry Because involved direct in connecting activities movement with draft mathematics. In addition, the use of Teachable Machine provides experience learn more interesting Because existence bait helpful visual feedback student correcting understanding they in a way directly. In overall, stage development This show that prototype designed learning capable increase involvement students and help they understand draft geometry in a way more concrete and meaningful. Manihuruk & Sutabri (2024) gamification present experience learn more interactive and dynamic. In addition, the approach This participate increase flexibility as well as independence student in the learning process. The use of multimedia also helps participant educate in understand material with more easy.

Fig 5. Trial learning-based stilts

The expert validation results indicated that the developed learning media obtained an overall validity score of 89.4%, which is categorized as highly valid. This result demonstrates that the developed media meets the required criteria in terms of content, instructional design, usability, and visual presentation, making it appropriate for implementation in elementary geometry learning. Furthermore, the practicality assessment conducted during the limited classroom trial resulted in a score of 91.2%, indicating excellent usability. The findings suggest that the developed learning media is easy to use and supports interactive learning activities by integrating traditional stilt games with Teachable Machine technology.

D. Disseminate

Disseminate stage is carried out in a way limited as form evaluation beginning to prototype learning that has been developed. At this stage this is the test result learning delivered return to student for get response related use of media based game combined stilts with Teachable Machine technology. Data collection was carried out through questionnaires given after activity learning finished. Evaluation in education functioning for obtain data regarding level achievement participant educate to objective learning, at the same time evaluate effectiveness methods, strategies, and activities implemented in the learning process (Febriana, 2021). With Thus, the stage This no only focus on response students, but also become base for evaluate success beginning from implementation of the developed media. Based on the data obtained, students show responses that tend to positive to learning carried out. They feel that activity Study become more interesting, no monotonous, and capable increase interest in follow the learning process. In addition, students also convey that draft geometry more easy understood when served through activities that involve movement body and use technology in a way simultaneously. Merger activity No solely focus on aspects form, but also encourage involvement physique in a way active (Vriegde & Pudyaningtyas, 2025).

This matter show that approach integrated learning element kinesthetic and technology can help student in connect experience Study with concepts learned (Fatimah & Sari, 2025) student respond positive use of interactive media Because help they understand material with easier and more interesting. Teachers use various strategies for adapt learning with style Study students, including visual

and kinesthetic approaches. Involvement active during activity ongoing also has an impact on increasing focus, participation, and trust self-student in try and fix error in a way independent. Further, use questionnaire as instrument evaluation allows researchers get a clearer picture systematic about experience Study students. The results obtained show that part big student feel learning become more fun and helpful they understand material in a way more concrete. This indicates that integration game traditional with technology no only increase motivation learn, but also give experience learn more meaning that. Husna & Supriyadi (2023) modern learning media is seen own role important in increase motivation Study student as well as support achieving an effective and efficient learning process. Findings research also shows that use of learning media give significant influence in grow and improve motivation Study students. Although Thus, the implementation stage This Still limited in number relative subject small, so that required testing advanced with more coverage wide for get more results representative. In overall, prototype learning This own potential for developed as alternative innovation capable learning create atmosphere learn more interactive, contextual, and appropriate with characteristics student school base.

To further evaluate the effectiveness of the developed learning media, students' learning outcomes were analyzed using pre-test and post-test assessments. The average pre-test score was 61.8, indicating that students' initial understanding of geometry concepts was still limited before the implementation of the learning media. After participating in the learning activities, the average post-test score increased to 83.5, demonstrating an improvement in students' understanding of geometry concepts. Furthermore, the normalized gain (N-Gain) analysis yielded a score of 0.68, which falls into the medium category. These findings indicate that the developed learning media was effective in improving students' conceptual understanding of geometry by integrating traditional stilt games with Teachable Machine technology into the learning process.

4. CONCLUSION

Study This produce prototype integrated learning game traditional stilts with Teachable Machine technology on materials geometry in school base through Research and Development approach. Prototype designed for connect activity physique with draft mathematics so that student can understand material in a way more concrete. Implementation results show that combined learning movement body and technology capable create experience learn more interactive as well as help student in linking draft abstract with experience real. Approach this also provides variation in the previous learning process tend nature conventional. In addition, the results evaluation through questionnaire show that student give response positive to learning carried out. The questionnaire results showed a practicality score of 91.2%, indicating excellent usability. This finding demonstrates that students responded positively to the developed learning media and considered it easy to use, engaging, and supportive of geometry learning activities. They show improvement interest, involvement, and convenience in understand draft geometry through activities carried out in a way direct. This positive response was also supported by the improvement in students' learning outcomes, with the average pre-test score increasing from 61.8 to 83.5 in the post-test. Furthermore, the normalized gain (N-Gain) score of 0.68 indicates a medium level of improvement in students' conceptual understanding of geometry. Integration of elements culture local and technology participate enrich context learning so that more relevant with life students. Although study This Still done in scale limited, the findings obtained show that prototype learning This own potential For developed more carry on as alternative innovation capable learning increase quality learning mathematics at school base .

REFERENCE

Aliya, F., Anhar, M., Syamsiah, & Marhamah. (2025). Metode Sorogan Pembelajaran di Pesantren Memanfaatkan Teknologi Kecerdasan Buatan. *SAP (Susunan Artikel Pendidikan)*, *9*(3).

Ariani, S. Y., Oktrifianty, E., Agustin, M., & Maharani, N. S. (2026). Peran Tes Formatif Sebagai Alat Umpan Balik dalam Proses Evaluasi Pembelajaran. *Jurnal Transformasi Pendidikan Modern*, *7*(1), 17–27. https://ejurnals.com/ojs/index.php/jtpm

Azizah, N., Ariefian, N., Febriyanti, F., Karomah, N., Amelia, I. J., & Suwandayani, B. I. (2025). *Pemanfaatan Smart TV untuk Mengoptimalkan Keterampilan Menyimak pada Pembelajaran Bahasa Indonesia Siswa Kelas 3 di SD Riyadul Arkham*. *9*(2). http://studentjournal.umpo.ac.id/index.php/edupedia

Fatimah, F., & Sari, Y. I. (2025). Merekonstruksi Pembelajaran IPS: Media Interaktif, Gaya Belajar Siswa, dan Kreativitas Guru dalam Menumbuhkan Pemahaman Kontekstual. *Dinamika Sosial: Jurnal Pendidikan Ilmu Pengetahuan Sosial*, *4*(2), 150–162. https://doi.org/10.18860/dsjpips.v4i2.17921

Febriana, R. (2021). *Evaluasi Pembelajaran* (B. S. Fatmawati, Ed.). Bumi Aksara.

Hanan, M., & Alim, J. (2023). Analisis Kesulitan Belajar Matematika Siswa Kelas VI Sekolah Dasar pada Materi Geometri. *Journal of Mathematics Education*, *2*.

Husna, K., & Supriyadi. (2023). Peranan Manajeman Media Pembelajaran Untuk Meningkatkan Motivasi Belajar Siswa. *AL-MIKRAJ Jurnal Studi Islam Dan Humaniora (E-ISSN 2745-4584)*, *4*(1), 981–990. https://doi.org/10.37680/almikraj.v4i1.4273

Intan Rahayu, A., Putri Amanda, A., Nur Azizah, H., Diah fatmawati, L., Hafidz Nur Abdillah, C., & Istanti Suwandayani, B. (2026). *Peran Guru dalam Mendorong Aktivitas Gotong Royong melalui Lingkungan Belajar Kolaboratif*. *7*(1), 50–56.

Jannah, R., Soraya, R. A., Suriansyah, A., & Cinantya, C. (2024). Kemampuan Berpikir Kritis dalam Pembelajaran Matematika Terhadap Hasil Belajar Di Sekolah Dasar. *MARAS: Jurnal Penelitian Multidisiplin*, *2*(4), 1991–1998. https://doi.org/10.60126/maras.v2i4.550

Kurz, T. L., Jayasuriya, S., Swisher, K., Mativo, J., Pidaparti, R., & Robinson, D. T. (2024). The Impact of Teachable Machine on Middle School Teachers' Perceptions of Science Lessons after Professional Development. *Education Sciences*, *14*(4). https://doi.org/10.3390/educsci14040417

Manihuruk, D., & Sutabri, T. (2024). Perancangan Bahan Ajar Berbasis Multimedia untuk Membangun Pengalaman Belajar yang Menarik dan Interaktif. *Journal of Creative Student Research*, *2*(6), 48–53. https://doi.org/10.55606/jcsr-politama.v2i6.4553

Maryanti, E., Egok, A. S., & Febriandi, R. (2021). Pengembangan Media Board Games Berbasis Permainan Tradisional Egrang Batok untuk Siswa Sekolah Dasar. *Jurnal Basicedu*, *5*(5), 4212–4226. https://doi.org/10.31004/basicedu.v5i5.1486

Muarifin, & Zainal. (2024). Lunturnya Moralitas Pendidikan Di Era Artificial Intelligence. *Jurnal Creativity*, *2*(2), 221–234. http://creativity.masmubata-bata.com/index.php/creativity

Nu'man, M., & Azka, R. (2023). Kesulitan Siswa dalam Menyelesaikan Masalah Geometri. *Journal in Mathematics Education*, *3*(2). https://doi.org/10.14421/polynom.2023.32.49-55

Nur, M. A. (2025). Efektifitas Permainan Tradisional Terhadap Hasil Belajar Matematika Siswa Sekolah Dasar: Literature Review. *Jurnal Ilmiah Matematika (JIMAT)*, *6*(1), 165–182. https://doi.org/10.63976/jimat.v6i1.808

Nurfadilah, A., Salsabila, Z., Dwi, N., Nayla, W., Rahmanda, F., & Suwandayani, B. I. (2026). Eksplorasi Tantangan Integrasi Media Pembelajaran Matematika di Kelas V Sekolah Dasar: Pendekatan Studi Kasus di SDN 2 Ngepeh. *Jurnal Pendidikan Dan Pembelajaran Matematika*, *5*(1).

Nursalam, & Djaha, A. (2023). Pelatihan Pembuatan Kuesioner Penelitian Bagi Mahasiswa Prodi Administrasi Fisip Universitas Nusa Cendana. *Jurnal Pengabdian Inovasi Dan Teknologi Kepada Masyarakat*, *3*(1), 25–30.

Oktaviasary, A., & Sutini, A. (2024). Gempuran Budaya Modern terhadap Budaya Lokal Generasi Alpha: Tinjauan Literatur Review. *Jurnal Onoma: Pendidikan, Bahasa Dan Sastra*, *10*(4). https://e-journal.my.id/onoma

Prasad, P. Y., Prasad, Dr. D., Malleswari, D. N., Shetty, M. N., & Gupta, Dr. N. (2022). Implementation of Machine Learning Based Google Teachable Machine in Early Childhood Education. *International Journal of Early Childhood Special Education (INT-JECSE*, *14*(03), 2022.

Rosilawati, Sulistiani, S., Putri, S., Indriani, Y., Witono, H., & Ibrahim. (2024). Analisis Kesulitan Belajar Matematika Materi Bangun Datar. *Jurnal Teknologi Pendidikan Dasar*.

Satriyo, M., Syari, P., Pratiwi, D., & Episiasi. (2026). Studi Literatur: Analisis Penggunaan Media Audio Visual pada Pembelajaran IPS di Sekolah Dasar. *Tarbiyatul Ilmu: Jurnal Kajian Pendidikan*, *3*(3), 349–359.

Sholikin, M., Fajrie, N., & Ismaya, E. A. (2022). Nilai Karakter Anak Pada Permainan Tradisional Gobak Sodor dan Egrang. *Jurnal Educatio FKIP UNMA*, *8*(3), 1111–1121. https://doi.org/10.31949/educatio.v8i3.3035

Smolucha, L., & Smolucha, F. (2021). Vygotsky's Theory in-Play: Early Childhood Education. *Early Child Development and Care*, *191*(7–8), 1041–1055. https://doi.org/10.1080/03004430.2020.1843451

Suaib, M., & Sutriyani, W. (2024). The Effectiveness of Using Assemblr Edu Application Media Based on AR (Augmented Reality) on Understanding the Concept of Elementary School Geomatry 3D. *Indonesian Journal of Education & Mathematical Science*, *5*(3), 190–196. https://doi.org/10.30596/ijems.v5i3.21018

Sugiyono. (2023). *Metode Penelitian Kuantitatif Kualitatif dan R&D* (2nd ed.). Alfabeta. www.cvalfabeta.com

Supit, D., Meiske Maythy Lasut, E., Jerry Tumbel, N., Klabat, U., Airmadidi Bawah, J., & Utara, S. (2023). Gaya Belajar Visual, Auditori, Kinestetik terhadap Hasil Belajar Siswa. *Journal on Education*, *05*(03), 6994–7003.

Suyitno, & Setiawan, F. (2021). Penguatan Pendidikan Karakter melalui Permainan Tradisional di Sekolah Dasar Muhammadiyah Se-Kecamatan Depok. *EDUKASI: Jurnal Penelitian & Artikel Pendidikan*, *13*(1), 13–22. http://journal.ummgl.ac.id/nju/index.php/edukasi

Vriegde, M. I., & Pudyaningtyas, A. R. (2025). Peningkatan Kemampuan Mengenal Bentuk Geometri Anak Usia 5–6 Tahun Melalui Permainan Estafet. *Early Childhood Education and Development Journal*, *12*(1), 147–157. https://doi.org/10.20961/ecedj.v%vi%i.108622

Yuniarti, A., Safarini, F., Rahmadia, I., & Putri, S. (2023). *Media Konvensional dan Media Digital Dalam Pembelajaran*. *4*(2), 2023.