

Development of a TGT-Based MONUSCAR for Teaching Cultural Diversity in Elementary Schools

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ABSTRACT

Elementary students' understanding of Indonesia's cultural diversity remains low. Many teachers present material theoretically with minimal use of instructional media, leading to student boredom and a lack of engagement in the learning process. Elementary students are in the concrete operational stage of development, which necessitates the use of tangible, interactive, and enjoyable instructional media. Monopoly-style games can foster student interaction and convey cultural content in a flexible way. Existing Monopoly-style media are generally two-dimensional and lack interactive features. This limitation presents a research opportunity: there is currently no Monopoly-style game that combines sensor-based interactivity with cooperative learning to teach cultural diversity. This study develops MONUSCAR (Monopoli Nusantara with Light Effects and MP3 Module) to address this gap. MONUSCAR is a three-dimensional, Monopoly-style educational game that integrates Indonesian cultural diversity with LED lights, photoelectric switch sensors, and an MP3 module. Previous Monopoly-style media were typically two-dimensional and static. MONUSCAR differs from these designs by incorporating LED lights and sensor-triggered audio feedback, integrated via the Teams Games Tournament (TGT) model. This multisensory approach to teaching cultural diversity has not been reported in previous studies and represents the primary scientific contribution of this research. Methodologically, the study employs a Research and Development (R&D) approach based on the Borg and Gall model as modified by Sugiyono, comprising 13 systematic stages. To foster cooperative learning, the researcher integrated MONUSCAR with the Teams Games Tournament (TGT) model. The research subjects consisted of 130 fourth-grade students at MI Mu'allimat Cukir Jombang. Data were collected through interviews, observations, questionnaires, pre-tests, and post-tests. Subject matter experts awarded a validation score of 84.50%, placing the media in the highly feasible category. A media expert assigned a validation score of 91.63%, placing it in the highly feasible category. Students responded positively, with an average score of 90.33%. Student learning outcomes improved, with the average pre-test score rising from 56.00 to 86.28 on the post-test. MONUSCAR achieved an N-gain score of 0.70, falling into the high category. The Wilcoxon test yielded a p-value of 0.000. These results underscore the use of MONUSCAR to enhance learning outcomes regarding Indonesia's social and cultural diversity.

Keywords: board game, cultural diversity, interactive learning media, primary education, social studies learning

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INTRODUCTION

Cultural diversity is a vital component of Indonesia's national identity. It appears in the nation's traditions, languages, and customs. Teachers can leverage this diversity as a learning resource to foster tolerance and mutual respect within a pluralistic society (Afriliani et al., 2024). Globalization has heightened the urgency of such efforts, given the risk of eroding national identity among the younger generation due to students' inclination toward foreign cultures (Rahayu et al., 2025). Multicultural education strengthens students' competence in navigating cultural differences (Jayadi et al., 2022). In addition, it enhances student engagement by fostering better peer relationships (Abacioglu et al., 2023). The benefits of such engagement are maximized when teachers design learning tasks grounded in complex, real-world classroom situations (Anyichie & Butler, 2023). Addressing this need, the Indonesian government has integrated cultural diversity into the 2013 Curriculum and, more recently, into the *Kurikulum Merdeka* (Independent Curriculum) at the primary school level (Ali & Mulasi, 2023). This policy reflects a national commitment to instilling awareness and appreciation of diversity from an early age.

The 2013 Curriculum presents this material through Theme 7, "The Beauty of Diversity in My Country," for fourth-grade students (Kusumawati, 2017). In contrast, the *Kurikulum Merdeka* integrates this material into the Natural and Social Sciences (IPAS) subject (Fitri et al., 2021). These curriculum policies have spurred the creation of various multicultural-oriented teaching materials at the primary school level. Researchers have developed arts and culture worksheets for this purpose (Antosa et al., 2017). Other researchers have validated a multicultural competence instrument for teachers (Zufriady et al., 2025). Curriculum developers have also compiled Malay culture-based IPAS materials (Guslinda et al., 2025). Language and arts learning resources designed with similar multicultural objectives have been shown to strengthen students' critical reasoning skills (Wibowo, 2021). This instruction aims to foster attitudes and values that shape national character, going beyond mere mastery of subject matter. Children engaged in culture-based activities, such as traditional dance, show stronger character development (Br Depari et al., 2021). The internalization of broader multicultural values, moreover, enhances students' multicultural competence (Mardhiah et al., 2024).

However, its implementation at the elementary school level still faces practical challenges. Interviews with fourth-grade teachers at MI Mu'allimat Cukir Jombang reveal that instruction remains largely theoretical, with teachers relying on textbooks that lack sufficient illustrations. This reliance makes it difficult for students to gain a concrete understanding of topics such as traditional houses, clothing, and regional dances. Consequently, students indicate low engagement, boredom, and a decline in learning interest. Classroom observations also highlight a lack of interactive and hands-on learning media capable of bridging the gap in conceptual understanding.

Game-based strategies and adaptive activities align better with students' concrete operational stage than theoretical instruction (Susanto et al., 2024). Board games, in particular, contribute to the development of students' social skills (Sirichuenichit & Prarakijjak, 2025). Such games foster an understanding of diversity through participatory play (Merkuri et al., 2025). Monopoly is the most widely played board game globally, making it highly suitable for this purpose (Hackett & Coghlan, 2023). Most students are already very familiar with the game (Adilah & Minsih, 2022). The Monopoly format allows for the highly flexible incorporation of cultural content (Nur Janah et al., 2023), and familiarity with the game can further encourage active participation among players (Dellarosa & Nafisah, 2024). Researchers have developed Monopoly-based learning media focused on Indonesia's cultural diversity for Social Studies (Khaerunisa et al., 2022). Meanwhile, the TGT model has proven effective in improving learning outcomes within cooperative learning environments (Suwarni, 2019) and enhancing student motivation (Putri et al., 2023). Researchers have combined TGT with Monopoly to teach material regarding the hydrosphere (Alda et al., 2022). A similar approach has also been taken by integrating TGT with the game Snakes and Ladders to support learning activities (Maharani et al., 2021).

Several studies have developed monopoly-based media for elementary education, yet three gaps remain. Developmentally, existing products such as MOSIDA, built for local wisdom content (Nur Janah et al., 2023), and monopoly-based science media (Ardhani et al., 2021; Hikmah et al., 2023), remain limited to two-dimensional boards without sensor-based interactivity. Technologically, none of these products combine light and audio feedback with the Teams Games Tournament (TGT) model. Contextually, none of them specifically addresses cultural diversity content for elementary learners. The researcher, therefore, developed MONUSCAR to address these gaps. MONUSCAR is a technology-based, three-dimensional monopoly game medium that combines cooperative learning with multisensory involvement.

This study is distinguished from previous monopoly-based media by three contributions. First, it introduces a three-dimensional monopoly medium integrated with photoelectric sensors, LED lights, and MP3 audio feedback, rather than the static two-dimensional boards used in earlier products. Second, it embeds this sensor-based medium directly into the Teams Games Tournament (TGT) cooperative learning model, combining multisensory feedback with structured peer competition rather than applying them separately. Third, it provides empirical evidence of the medium's feasibility and effectiveness specifically for cultural diversity content, an application not previously reported in the monopoly-based media literature.

This study offers elementary teachers a validated, technology-enhanced learning medium that renders abstract cultural diversity content concrete, interactive, and engaging. Such a medium carries particular significance for students at the concrete-operational stage, since these learners depend on tangible, multisensory experiences to internalize abstract concepts. This significance, therefore, establishes the rationale for the present study, which develops a TGT-based MONUSCAR medium for fourth-grade elementary students. The study subsequently evaluates this medium's feasibility and effectiveness in teaching cultural diversity content, thereby generating empirical evidence to support its use in classroom practice.

LITERATURE REVIEW

Theoretical Framework: Cooperative Learning and Cognitive Load

The developmental, technological, and contextual gaps identified above share a common theoretical root, drawn from three interconnected strands: cooperative learning theory, cognitive load theory, and the developmental need for multisensory reinforcement of cultural content. Cooperative learning structures such as TGT foster peer interaction and accountability (Slavin, 2015). A separate account of cooperative learning confirms this same pattern of peer interaction and accountability (Gillies, 2016). This pattern rests on a broader principle: positive interdependence among group members forms the core of successful cooperation (Johnson & Johnson, 1993). Game-based media also reduces cognitive load through concrete, playful representation (Sweller, 2011), a mechanism that directly addresses the developmental gap left by existing two-dimensional monopoly products. Cultural content, in turn, needs vivid, multisensory reinforcement. Concrete-operational learners depend on this reinforcement to internalize the material (Susanto et al., 2024), underscoring the contextual gap around culturally themed content noted earlier. MONUSCAR brings these three strands together by pairing TGT's cooperative structure with sensor-based light and audio feedback, directly targeting the technological gap that no prior monopoly medium has closed. Meta-analytic evidence implies this combination of cooperative learning and cultural content. Cooperative learning interventions produce a moderate positive effect on intergroup relations (Tondok et al., 2024). A separate meta-analysis in physical education settings corroborates this finding. That meta-analysis reveals that cooperative learning approaches also produce meaningful gains in students' learning outcomes in that setting (Boke et al., 2025).

Empirical Evidence on Board Games and Game-Based Learning

Broader empirical evidence bolsters this pattern. Gamification-based approaches support student engagement and learning outcomes (Vrcelj et al., 2023). Systematic observations report similar improvements in engagement and learning outcomes through gamification (Li et al., 2023). Board games and tabletop games offer comparable benefits (Sousa et al., 2023). More recent reviews confirm these benefits specifically for collaborative science learning (Othman et al., 2025). In addition, these benefits extend to improved numeracy skills gained from number-themed board games played by parents and children (Cheung & McBride, 2017). Improvements in numeracy have also been reported in association with board game use in classroom settings (Balladares et al., 2023). General learning improvements have also been observed among young children (Alotaibi, 2024). Similar results have been documented in primary school classrooms (Safrizal et al., 2026). Overall, these theoretical and empirical studies confirm that cooperative learning, game-based media, and board game formats can each independently enhance student engagement and learning outcomes; however, no research has yet examined these mechanisms in combination within a sensor-based, three-dimensional medium designed for cultural diversity content. Consequently, this review of the literature reinforces, rather than merely reiterates, the developmental, technological, and contextual gaps outlined in the Introduction, and establishes the foundation for the development and empirical testing of MONUSCAR using the methodology described below.

METHOD

This research adopts a Level 3 Research and Development design. This level emphasizes developing and refining existing products to optimize effectiveness, efficiency, ease of use, attractiveness, and user satisfaction (Sugiyono, 2022). Development procedures followed the Borg and Gall model as simplified by Sugiyono (2022), a simplification offering greater applicability and easier implementation within educational research contexts. Researchers selected this model over alternatives such as ADDIE and Plomp for a specific reason. Iterative field testing across limited, main, and operational trial stages provides a feature necessary for validating a physical, sensor-based product like MONUSCAR under authentic classroom conditions. ADDIE, by comparison, orients toward instructional design and includes only a single evaluation stage. Plomp emphasizes formative evaluation yet lacks the staged field-testing structure required for refining a hardware-integrated medium.

Sugiyono's (2022) simplification into thirteen stages, therefore, suited this study more closely, guiding subsequent development procedures in a systematic fashion. Early stages comprised initial product analysis, literature review and field studies, product planning, internal design testing, and design revision. Later stages covered product manufacturing, limited field testing, first revision, main field testing, second revision, operational field testing, third revision, and dissemination and implementation. Researchers carried out each stage continuously throughout this process, applying a principle of repeated evaluation consistently across every phase. This principle ensured resulting product quality matched user needs and learning context requirements.

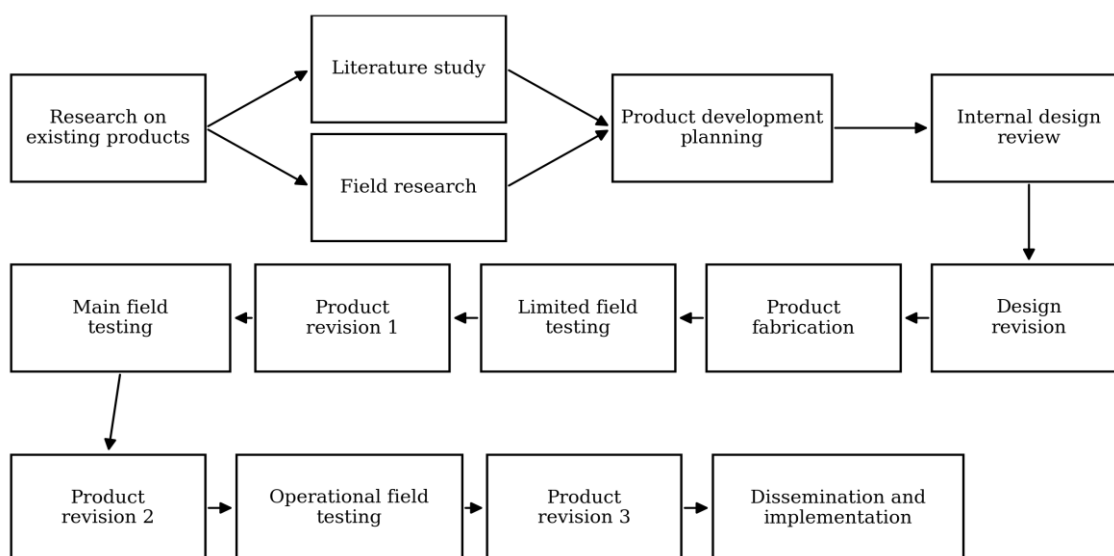


Figure 1. R&D research steps

This study was conducted at MI Mu'allimat Cukir Jombang, involving a population of 130 fourth-grade students. The sample was determined using a 5% margin of error to ensure adequate representation. Purposive sampling was employed, with specific criteria relevant to the research objectives. The research subjects included one fourth-grade science teacher who served as the initial informant. Subject matter experts in arts and culture, along with media experts in informatics and graphic design, acted as validators. Testing was carried out in stages, involving 12 students in the limited trial, 20 students in the main field trial, and 98 students in the operational field trial. Sample measurements at each stage were determined using the Isaac & Michael formula with a 5% margin of error, adjusted to meet development requirements (Sugiyono, 2022). The research instruments included interviews, observations, questionnaires, and learning outcome tests.

Interviews and observations were used to identify learning problems and media development needs in more depth.

Questionnaires were used by experts to validate the process and to determine students' responses to the use of the developed media. The test instrument consisted of 20 multiple-choice questions, used as a pre-test and post-test. These measured the effectiveness of the MONUSCAR medium in enhancing students' understanding of the cultural diversity of the Indonesian archipelago. The instrument's development was systematic, with attention to alignment between learning indicators and the desired objectives.

The validity of the test instrument was tested through content validity, involving three experts with relevant competencies. This assessment focused on the alignment of the test items with core competencies, learning indicators, and the cognitive abilities of fourth-grade students. A science teacher, acting as a learning practitioner, reviewed the pre-test and post-test. This review ensured alignment with real-world classroom conditions. Using 30 fifth-grade students at MI Mu'allimat Cukir Jombang as pilot respondents outside the main research subjects, the researcher validated the questionnaire. An item is considered valid if the calculated r value exceeds the table r value of 0.361. This threshold was set based on $df = n - 2 = 28$ at a significance level of 0.05 (Sugiyono, 2022). Instrument reliability was tested using Cronbach's Alpha coefficient, with the assistance of IBM SPSS Statistics version 22, to determine internal consistency.

Data collection began with a needs analysis. Interviews with fourth-grade science teachers and classroom observations followed to identify student characteristics, learning challenges, and the need for appropriate media. Findings from this analysis phase served as the basis for the initial design of MONUSCAR medium, including aspects of game design and learning materials. The researcher developed the product using CorelDRAW X7. Material and media experts subsequently validated the product to ensure appropriate content and presentation. Revised product testing proceeded through limited trials, main field trials, and operational field trials. These trials assessed the feasibility, practicality, and effectiveness of the media's use. Questionnaire data were subsequently analyzed using percentage analysis techniques based on the criteria proposed by Arikunto et al. (2018).

Table 1. Media eligibility criteria

Scores in Percent (%)	Eligibility Categories
<21%	Very unfeasible
21 – 40%	Not feasible
41 – 60%	Quite feasible
61 – 80%	Feasible
81 – 100%	Very feasible

Data regarding effectiveness were collected during the operational field trial phase using a one-group pretest-post-test design. Students took a pre-test prior to instruction and a post-test after using the MONUSCAR medium, which was developed based on the Teams Games Tournament (TGT) model. A comparison of the results from both tests was used to quantitatively identify improvements in student learning outcomes. Observations were also conducted during the learning process to assess the level of student engagement, thereby providing a more comprehensive description of the media's effectiveness.

Data analysis used qualitative and quantitative approaches. Qualitative data, including expert suggestions and input, were analyzed descriptively to inform product improvements. Quantitative data from the questionnaire were processed into percentages to determine the appropriateness of the media. Learning outcome data were first tested for normality using the Kolmogorov-Smirnov and Shapiro-Wilk techniques. These tests indicate a significance value of 0.000 ($p < 0.05$). This result indicates that the data were not normally distributed. Hypothesis testing, therefore, used the nonparametric Wilcoxon Signed Ranks Test. This test was run with IBM SPSS Statistics version 22 at a significance level of 0.05 to determine differences between pre-test and post-test scores. Improvement in learning outcomes was analyzed using the normalized

gain score (n-gain), according to the Hake (2002) formula. The researcher interpreted the resulting score according to established criteria to determine the improvement category.

$$n\text{-gain} = \frac{\% \text{ postes} - \% \text{ pretes}}{100 - \% \text{ pretes}}$$

Table 2. Classification of N-Gain Score

Ranges of N-Gain Score	Increase Categories
$g < 0.30$	Low
$0.30 \leq g \leq 0.70$	Medium
$g > 0.70$	High

RESULTS AND DISCUSSION

Instrument Development and Validity Testing

The research instruments employed included questionnaires for subject matter experts, media experts, and students, as well as pre-test and post-test questions. These instruments were used to gather data supporting the study. Expert assessments established the content validity of the instruments. Three experts validated the questionnaires, while a science teacher reviewed the pre-test and post-test questions. This assessment ensured that the presented material aligned with learning indicators and that the language used in each question item was clear. Based on the assessment results, the researcher concluded that the questionnaires were feasible for use following several revisions. The science teacher's review indicated that all 20 pre-test and post-test questions were feasible for use without requiring revision.

The instrument's item validity was assessed using Corrected Item-Total Correlation with an r table of 0.361. All 20 items in the subject matter expert questionnaire were declared valid, with calculated r values ranging from 0.562 to 0.892, all exceeding the r table of 0.361. Similar results were also found in the media expert questionnaire, with calculated r values ranging from 0.630 to 0.953, and all items were declared valid. This consistency of validity continued in the student response questionnaire, which obtained calculated r values ranging from 0.695 to 0.933, thus declaring all 20 items valid.

Instrument reliability testing was conducted using Cronbach's Alpha coefficients using SPSS. The analysis reveals that the reliability value for the material expert questionnaire was 0.964, the media expert questionnaire was 0.976, and the student response questionnaire was 0.972. Reliability interpretation refers to established criteria. A value of $r_{11} < 0.400$ is considered low, $0.400 < r_{11} < 0.700$ is considered medium, and $r_{11} > 0.700$ is considered high. All research instruments fall into the high category based on these criteria and qualify as reliable.

MONUSCAR Product Development and Features

The development of the MONUSCAR medium involved a series of systematic stages, namely expert validation, multi-stage trials, and effectiveness testing with 130 fourth-grade students at MI Mu'allimat Cukir Jombang. This resulting product consists of several integrated components. Its board is three-dimensional, measuring 60 x 60 cm on each side.

Its material is sturdy acrylic, stable enough for repeated use. This board is connected to a power source to support the electronic system within. Main components consist of six MP3 modules and 44 LED lights. Sensors further equip the board, namely an Omron E3JK-DR12-C photoelectric switch sensor and 12 Omron E3Z-D82 photosensors. Sensor selection follows Zhu and Wu (2025), who demonstrated that responsive sensors in learning media increase student engagement and cognitive performance. This aligns with evidence that combining tangible interfaces with multiple sensory channels helps young learners retain material better than screen-only tools (Di Fuccio et al., 2025). This system enables the board to automatically respond with light and sound during use.



Figure 2. MONUSCAR Board

The MONUSCAR medium is equipped with a sensor activation component in the form of a special card or marker that triggers the Omron E3JK-DR12-C photoelectric switch sensor. When the marker is placed on the sensor point on the board, the system responds by turning on the LED light and playing audio according to the game square. Game pawns are made of acrylic with designs resembling figures dressed in traditional Indonesian clothing. Player movements do not use dice, but rather spin to determine the move. This medium is also equipped with cultural diversity cards that contain brief information about the customs and cultural diversity of the Indonesian archipelago. Folklore cards round out the set, letting players answer questions presented through audio from the MP3 module.



Figure 3. MONUSCAR Equipment

This medium includes various game cards designed to reinforce cultural literacy. Javanese Script cards serve as a practical tool for practicing writing and transliteration. Prison cards feature challenging questions that players must answer to secure their release. Property cards present brief provincial profiles, quiz mechanics, and land purchase prices. Folk Song cards combine lyrics with a barcode scanning feature for digital access to the melodies. All transactions utilize culturally themed play money as the medium of exchange.



Figure 4. MONUSCAR Equipment

A timer is used to control the game's duration, ensuring efficiency and discipline. This approach aligns with findings that time management can enhance student organization (Torres-Munares et al., 2024). The game

awards medals to foster learning motivation. This reward system supports Self-Determination Theory, which emphasizes the importance of a sense of competence derived from positive feedback (Ryan & Deci, 2020). It also aligns with behaviorist theory, which posits that positive reinforcement, such as the awarding of prizes, can strengthen desired behaviors (Skinner, 1974). Separate guidebooks are provided for the moderator and the players. These guides help manage cognitive load and maintain focus on learning (Sweller, 2011). Clear instructions also facilitate teamwork during complex tasks (Paas & Sweller, 2012). The moderator's guide contains the answer key, whereas the player's guide includes only instructions on how the game is played.



Figure 5. MONUSCAR Equipment

Feasibility and Validation Results

The MONUSCAR product was subsequently tested for its feasibility through validation by material experts, media experts, and student responses. This development process went through a series of systematic stages, namely expert validation, multi-level trials, and effectiveness testing on 130 fourth-grade students at MI Mu'allimat Cukir Jombang. The validation results reveal that the developed media met the criteria for being very feasible, both in material and media aspects.

Table 3. Results of the Material Expert Validation Test (N=2 Validators)

Assessment Aspects	Number of Questions	Total Score	Average	Percentage (%)	Eligibility Levels
Learning	8	55.20	3.45	86.25%	Very feasible
Material	7	49.00	3.50	87.50%	Very feasible
Language	5	31.00	3.10	77.50%	Feasible
Total	20	135.20	3.38	84.50%	Very feasible

The 84.50% validation rate (very feasible) indicates that the media exceeded the > 80% standard set by Arikunto et al. (2018). This achievement confirms the effectiveness of the design in supporting learning. It also aligns with Abdoli et al. (2025), who identify visuals and interactions as determinants of feasibility. A high score on the visual aspect reflects optimal graphics, colors, animations, and design consistency. These elements effectively attract students' attention. Theoretically, this result aligns with Mayer (2009) and the principles of signaling and coherence, which maintain focus and reduce cognitive load. Maulidia and Muthi (2025) support this finding as well; their study indicates that interactive visual media effectively increase students' motivation and interest in learning.

Table 4. Results of Media Expert Validation Test (N=2 Validators)

Assessment Aspects	Number of Questions	Total Score	Average	Percentage (%)	Eligibility Levels
Effectiveness	4	18.00	4.50	100.00%	Very feasible
Efficiency	4	12.00	3.00	75.00%	Feasible
Electronics	3	13.50	4.50	100.00%	Very feasible
Design	9	39.15	4.35	96.88%	Very feasible
Total	20	82.65	4.13	91.63%	Very feasible

Media expert validation of 91.63% reveals that MONUSCAR medium meets the criteria of being very feasible in terms of effectiveness, electronics, and design. This score exceeds the material expert validation of 84.50%. The finding underscores that validators judged the medium's physical and technical execution more favorably than its content design. This execution includes sensor responsiveness, wiring, and LED and audio integration. This pattern indicates that the hardware functions reliably enough to avoid becoming a barrier to classroom use.

Table 5. Results of the Feasibility Test of Learning Media by Students

Field Testing	Number of Students	Practicality	Materiality	Satisfaction	Average (%)	Category
Limited	12	98.30%	82.20%	80.60%	87.03%	Very feasible
Main	20	88.70%	91.60%	91.20%	90.50%	Very feasible
Operational	98	90.40%	90.40%	91.90%	90.90%	Very feasible
Total	130	90.92%	89.58%	90.48%	90.33%	Very feasible

Student assessments reveal a consistent upward trend across trial phases from 87.03% to 90.50% to 90.90%. This trend may reflect a refinement effect. Feedback from earlier trials, such as adjustments to sensor responsiveness and card instructions, is incorporated before the next stage. This feedback gradually improves usability. MONUSCAR's practicality notably does not appear to depend on novelty alone. Acceptance stays high even as the sample expands from 12 to 98 students across more varied classroom conditions.

Table 6. Descriptive Statistics of Pretest and Posttest Scores (n = 98)

Data	N	Mean	Median	Sd	Min	Max	Range
Pre-test	98	56.00	59.00	12.24	20	80	60
Post-test	98	86.28	85.00	8.71	55	100	45

Effectiveness on Student Learning Outcomes

Student learning outcomes indicate a significant improvement following the implementation of the medium. A comparison of pre- and post-treatment scores indicated an increase in learning performance during the operational field trial phase. The average score rose from 56.00 on the pre-test to 86.28 on the post-test, an increase of more than 30 points. This rise shifted the class average from below the general passing threshold to a level demonstrating strong mastery of the cultural diversity material. Thus, the improvement appears practically meaningful for classroom learning outcomes, rather than merely statistically significant.

Table 7. Results of Pre-test and Post-test Normality Tests Using Kolmogorov-Smirnov and Shapiro-Wilk

Data	KS	Sig.KS	SW	Sig.SW	Decision
Pre-test	0.128	0.000	0.945	0.000	Abnormal
Post-test	0.134	0.000	0.910	0.000	Abnormal

Both normality tests indicate that the pre-test and post-test scores depart from normality, as neither the Kolmogorov-Smirnov nor the Shapiro-Wilk test produces a p-value above 0.05. This non-normal distribution violates the assumption required for parametric procedures such as the paired-samples t-test. The researcher, therefore, selects the Wilcoxon Signed Rank Test, a non-parametric alternative that compares paired scores without assuming normality. This methodological adjustment ensures that the subsequent hypothesis test yields a valid and reliable conclusion about MONUSCAR's effect on student learning outcomes.

Table 8. Results of the Wilcoxon Signed Rank Test

Variable	Negative ranks	Positive ranks	Ties	Z	Sig.	Decision
Pre-test – post-test	0	98	0	-8.632	0.000	H ₀ is rejected

The Wilcoxon Signed Rank Test is used to determine whether student learning outcomes differed significantly between the pre-test and post-test conditions. All 98 students record positive ranks with no negative ranks or ties, meaning every student's post-test score exceeds their pretest score. This uniform pattern, combined with a p-value below 0.05, leads to the rejection of the null hypothesis and confirms a statistically significant improvement in learning outcomes. Such a consistent gain across the entire sample underscores that MONUSCAR contributes reliably to student learning rather than benefiting only a subset of students.

Table 9. Results of N-Gain Analysis of Student Learning Outcomes

Data	Pre-test	Post-test	N-Gain
Average	56.00	86.28	0.70

The effectiveness of the developed media was further clarified through a normalized gain (n-gain) analysis, which showed a high score. This value indicates that the improvement in learning outcomes reached an optimal level. This finding shows that MONUSCAR's medium not only captured students' attention but also fostered a deeper understanding of Nusantara's cultural diversity. Conventional monopoly-based media typically report n-gain values in the medium range, 0.30–0.70 (e.g., Sakundari & Rizqi, 2024). MONUSCAR achieved a higher n-gain of 0.70. This result suggests that the added sensory feedback, rather than the monopoly format itself, is the main driver of this effectiveness gain. Both types of media share the same board-game structure but differ in interactivity.

Discussion

Interpreting the Effectiveness of MONUSCAR

Research findings indicate that the MONUSCAR medium has a very high level of feasibility for learning activities. This conclusion was supported by both expert evaluations and positive student feedback. The high feasibility rating reflected several key aspects, including the accuracy of the content, visual quality, and ease of use during the learning process. The material was presented in a structured and engaging manner, enabling students to easily grasp the concepts. This aligned with the characteristics of elementary students, who required concrete, visual, and interactive learning media to make the learning experience more meaningful and accessible.

Improved student learning outcomes were evident in the significant difference between pretest and post-test scores. The Wilcoxon Signed Rank Test confirms this difference. The n-gain value of 0.70 falls in the high category, indicating an optimal increase in understanding after students used the media. These findings reveal that interactive media made a significant contribution to learning outcomes in material on the cultural diversity of the Indonesian archipelago. Implementing the Teams Games Tournament (TGT) cooperative learning model also strengthened the media's effectiveness. Game activities combined with group collaboration encouraged active student involvement. Interaction between students created space for exchanging information and ideas, which supported a broader and deeper understanding of the concepts.

MONUSCAR medium combined game elements with technology such as sensors, LED lights, and MP3 modules. This integration created a multisensory learning experience. It engaged visual, auditory, and kinesthetic senses simultaneously. The medium increased the appeal of learning. In addition, it encouraged direct student involvement in the learning process. These characteristics provided MONUSCAR an advantage over conventional media, which were typically static and less interactive. This finding fits the broader literature on multimedia and multimodal instruction. The literature implies that combining multiple sensory channels supports learning more effectively than single-channel delivery (Abdulrahman et al., 2020). A related

editorial on multimodal learning reaches the same conclusion (Luo, 2023). Follow-up implementation took place in three elementary schools after the pilot at MI Mu'allimat Cukir Jombang. This implementation produced a relatively consistent positive response across schools. This consistency indicates that the media have a high level of flexibility and adaptability across learning contexts. Additionally, the developer exhibited the product at an expo as a dissemination effort to the community. This exhibition demonstrated the product's potential for broader use.

Furthermore, the superiority of MONUSCAR medium was reflected in its comprehensive components, designed to support various aspects of learning. Javanese script cards functioned to train written literacy based on local culture. Traditional song cards equipped with QR codes supported auditory reinforcement. Prison cards and property cards played a role in developing critical thinking skills and contextual problem-solving. Medium design was supported by attractive illustrations, varied color use, and a clear visual layout, facilitating student understanding. LED lights and MP3 audio further enhance the appeal and interactivity of learning. This variety of components demonstrated that the media functions not only as a play tool but also as a comprehensive learning tool.

Comparison with Previous Studies

This study's findings relate closely to previous research. Febuar and Arafat (2024) demonstrated a positive influence of the TGT model on learning outcomes among elementary students studying socio-cultural diversity. Sakundari and Rizqi (2024) similarly found that monopoly media improve students' numeracy and collaboration skills. An experimental study at a vocational high school reported a comparable pattern, indicating a significant post-test gain among students who learned through a monopoly-based TGT activity (Sa'id & Aini, 2024). MONUSCAR medium demonstrated higher gains still, reaching an n-gain value of 0.70, considered high. This difference points toward the superiority of three-dimensional, sensor-based media over conventional two-dimensional monopoly media. Researchers regarded MONUSCAR, to their knowledge, as the first sensor-integrated, three-dimensional monopoly medium designed specifically for cultural diversity content. This feature sets MONUSCAR apart from prior TGT-monopoly applications. Earlier applications focused on numeracy outcomes (Sakundari & Rizqi, 2024). Other applications focused on general socio-cultural outcomes without technological integration (Febuar & Arafat, 2024).

MONUSCAR's interactive features allowed students not only to play but also to experience the learning process directly. Susanto et al.'s (2024) findings confirm that game-based learning can optimally enhance student engagement and understanding. This effectiveness gap likely stems from a specific mechanism rather than the monopoly format alone. Conventional two-dimensional monopoly media convey cultural content mainly through text and static images, placing most processing burden on a single visual-verbal channel (Sweller, 2011). MONUSCAR instead distributed identical content across visual, auditory, and tactile channels through its sensors, LED lights, and MP3 modules. This distribution likely reduces cognitive load carried by any single channel and allows students to encode cultural material redundantly across senses (Susanto et al., 2024). Such a mechanism offered a plausible explanation for why MONUSCAR produced a high n-gain of 0.70, well above medium-range gains typically reported for conventional monopoly media (Sakundari & Rizqi, 2024).

CONCLUSION AND RECOMMENDATIONS

MONUSCAR medium, developed in combination with the Teams Games Tournament learning model, demonstrated high feasibility and effectiveness. This media proved effective in teaching the topic of Nusantara cultural diversity. An n-gain value of 0.70 fell within the high category. This value indicates that the media improved students' understanding optimally. Such a finding aligns with previous research, which found that combining the TGT model with game-based media, such as monopoly, can improve learning outcomes and students' collaborative abilities. MONUSCAR medium's main advantage lies in its three-dimensional design, which provides a more realistic learning experience. Interactive features such as sensors, LED lights, and audio further enrich this experience. These concrete characteristics suit the learning needs of

elementary students, who find it easier to understand material through direct experience. All formal trials, effectiveness testing, and statistical analysis reported in this study were conducted at MI Mu'allimat Cukir Jombang. Beyond this formal study, MONUSCAR has also been showcased at a public exhibition and used, without formal data collection, at three additional elementary schools, where informal observation likewise indicated a consistent, positive reception, suggesting the media's practical reliability and appeal across different learning situations.

Potential for further developing MONUSCAR medium remains open. Future developers could expand its use to other schools or apply it to other learning materials. This study contributes to existing literature in one key way, showing that multisensory, sensor-based feedback can strengthen the effectiveness of game-based cooperative learning beyond what conventional board-game media achieve. Such a contribution builds on prior TGT-monopoly research, which has largely relied on static, two-dimensional designs. Future research could examine MONUSCAR's long-term retention effects. Researchers could also investigate its cost-effectiveness for wider classroom adoption and its applicability to thematic content beyond cultural diversity.

Limitation

The limitations of the MONUSCAR medium lie in its relatively large size and complex structure, requiring two people to carry it. Using the medium also requires a power source and proper classroom management to ensure students remain focused and avoid distraction. The interactive, multisensory design requires more preparation time before the lesson begins. Teachers or moderators need to ensure all components, such as LEDs, sensors, cards, and pawns, are in good condition to ensure the learning process runs smoothly. In addition, the formal trial, effectiveness testing, and statistical analysis in this study were limited to a single school, MI Mu'allimat Cukir Jombang. Although MONUSCAR has also been showcased at a public exhibition and used informally in three other elementary schools, no formal data were collected in these instances; hence, the effectiveness findings reported here cannot yet be generalized across school settings without further formal testing.

Credit authorship contribution statement

AS: Conceptualization, Investigation, Data curation, Formal analysis, Writing - original draft, Visualization. YP: Methodology, Supervision, Writing - review & editing. AN: Conceptualization, Resources.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Ethical Declaration

All participants provided informed consent prior to their involvement in the study. They were informed about the study's purpose, procedures, and their right to withdraw at any time without consequence.

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REFERENCES

Abacioglu, C. S., Epskamp, S., Fischer, A. H., & Volman, M. (2023). Effects of multicultural education on student engagement in low- and high-concentration classrooms: The mediating role of student relationships. *Learning Environments Research*, 26(3), 951–975. <https://doi.org/10.1007/s10984-023-09462-0>

- Abdoli, S., Nili Ahmadabadi, M., Fardanesh, H., & Asgari, M. (2025). Design and validation of the usability framework of learning management systems. *Journal of Science and Technology Policy Management*, 16(9), 1579–1609. <https://doi.org/10.1108/JSTPM-01-2024-0027>
- Abdulrahman, M. D., Faruk, N., Oloyede, A. A., Surajudeen-Bakinde, N. T., Olawoyin, L. A., Mejabi, O. V., Imam-Fulani, Y. O., Fahm, A. O., & Azeez, A. L. (2020). Multimedia tools in the teaching and learning processes: A systematic review. *Heliyon*, 6(11), e05312. <https://doi.org/10.1016/j.heliyon.2020.e05312>
- Adilah, A. N., & Minsih, M. (2022). Pengembangan media pembelajaran monokebu pada siswa sekolah dasar. *Jurnal Basicedu*, 6(3), 5076–5085. <https://doi.org/10.31004/basicedu.v6i3.3026>
- Afriliani, M., Magdalena, M., Fitri, S. F. N., & Rustini, T. (2024). Analisis pendidikan multikultural pada siswa sekolah dasar melalui keragaman budaya. *Journal on Education*, 6(2), 11796–11804. <https://doi.org/10.31004/joe.v6i2.4978>
- Alda, P., Putra, M. J. A., & Erlisnawati, E. (2022). Pengaruh model pembelajaran kooperatif tipe Team Game Tournament berbantuan media monopoli hidrosfer terhadap hasil belajar siswa kelas V sekolah dasar. *Primary: Jurnal Pendidikan Guru Sekolah Dasar*, 11(6), 1763–1772. <https://doi.org/10.33578/jpkip.v11i6.8986>
- Ali, R., & Mulasi, S. (2023). Transformasi Kurikulum Merdeka: Pengembangan muatan lokal untuk meningkatkan identitas budaya. *ISTIFHAM: Journal of Islamic Studies*, 1(3), 219–231. <https://doi.org/10.71039/istifham.v1i3.35>
- Alotaibi, M. S. (2024). Game-based learning in early childhood education: A systematic review and meta-analysis. *Frontiers in Psychology*, 15, 1307881. <https://doi.org/10.3389/fpsyg.2024.1307881>
- Antosa, Z., Fendrik, M., & Helfianti, R. (2017). Pengembangan LKS dengan pendekatan multikultural pada pembelajaran seni budaya dan keterampilan di sekolah dasar. *Jurnal PAJAR (Pendidikan dan Pengajaran)*, 1(2), 181–192. <https://doi.org/10.33578/pjr.v1i2.4587>
- Anyichie, A. C., & Butler, D. L. (2023). Examining culturally diverse learners' motivation and engagement processes as situated in the context of a complex task. *Frontiers in Education*, 8, 1041946. <https://doi.org/10.3389/educ.2023.1041946>
- Ardhani, A. D., Ilhamdi, M. L., & Istiningsih, S. (2021). Pengembangan media pembelajaran berbasis permainan monopoli pada pelajaran IPA. *Jurnal Pijar MIPA*, 16(2), 170–175. <https://doi.org/10.29303/jpm.v16i2.2446>
- Arikunto, S., Jabar, C. S. A., & Yustiati, F. (2018). *Evaluasi program pendidikan: Pedoman teoretis praktis bagi mahasiswa dan praktis pendidikan* (Edisi 2). Bumi Aksara.
- Balladares, J., Miranda, M., & Cordova, K. (2023). The effects of board games on math skills in children attending prekindergarten and kindergarten: A systematic review. *Early Years*, 44(3–4), 710–734. <https://doi.org/10.1080/09575146.2023.2218598>
- Boke, H., Aygun, Y., Tufekci, S., Yagin, F. H., Canpolat, B., Norman, G., Prieto-González, P., & Ardigò, L. P. (2025). Effects of cooperative learning on students' learning outcomes in physical education: A meta-analysis. *Frontiers in Psychology*, 16, 1508808. <https://doi.org/10.3389/fpsyg.2025.1508808>
- Br Depari, F. A., Lumbangaol, R., Br Sembiring, R. K., & Tanjung, D. S. (2021). The relationship of Landek Karo traditional dance and the character education of children in Siosar Village, Kabupaten Karo. *Jurnal PAJAR (Pendidikan dan Pengajaran)*, 5(3), 550–568. <https://doi.org/10.33578/pjr.v5i3.8178>
- Cheung, S. K., & McBride, C. (2017). Effectiveness of parent–child number board game playing in promoting Chinese kindergarteners' numeracy skills and mathematics interest. *Early Education and Development*, 28(5), 572–589. <https://doi.org/10.1080/10409289.2016.1258932>
- Dellarosa, M., & Nafisah, D. (2024). Monopoly game to improve students' learning outcomes. *Journal of Contemporary Issue in Elementary Education (JCIEE)*, 2(2), 1–9. <https://doi.org/10.33830/jciee.v2i2.9766>
- Di Fuccio, R., Ponticorvo, M., Nadim, M. A., & Limone, P. (2025). Exploring the effect of digital and multisensory educational materials on retention in primary school using Tangible User Interfaces.

- Interactive Learning Environments*, 33(4), 2928–2938.
<https://doi.org/10.1080/10494820.2024.2427277>
- Febuar, V. S., & Arafat, Y. (2024). Pengaruh model pembelajaran Teams Games Tournament terhadap hasil belajar keberagaman sosial budaya sekolah dasar. *Jurnal Basicedu*, 8(4), 2694–2702.
<https://doi.org/10.31004/basicedu.v8i4.8191>
- Fitri, A., Rasa, A. A., Kusumawardhani, A., Nurya'bani, K. K., Fatimah, K., & Setianingsih, N. I. (2021). *Ilmu Pengetahuan Alam dan Sosial untuk SD Kelas IV*. Pusat Kurikulum dan Perbukuan, Badan Penelitian dan Pengembangan dan Perbukuan, Kemendikbudristek.
- Gillies, R. M. (2016). Cooperative learning: Review of research and practice. *Australian Journal of Teacher Education*, 41(3), 39–54. <https://doi.org/10.14221/ajte.2016v41n3.3>
- Guslinda, Munjiatun, Sari, I. K., & Alifarani, A. (2025). Development of teaching materials based on Melayu culture IPAS learning in elementary schools. *Jurnal PAJAR (Pendidikan dan Pengajaran)*, 9(2).
<https://doi.org/10.33578/pjr.v9i2.10116>
- Hackett, L. J., & Coghlan, J. (2023). Why Monopoly monopolises popular culture board games. *M/C Journal*, 26(2). <https://doi.org/10.5204/mcj.2956>
- Hake, R. R. (2002, August). *Relationship of individual student normalized learning gains in mechanics with gender, high school physics, and pretest scores on mathematics and spatial visualization*. Physics Education Research Conference. <http://www.physics.indiana.edu/~hake/PERC2002h-Hake.pdf>
- Hikmah, N., Ilhamdi, M. L., & Astria, F. P. (2023). Pengembangan media pembelajaran monopoli pintar berbasis permainan edukasi pada mata pelajaran IPA kelas V sekolah dasar. *Jurnal Ilmiah Profesi Pendidikan*, 8(3), 1809–1822. <https://doi.org/10.29303/jipp.v8i3.1537>
- Jayadi, K., Abduh, A., & Basri, M. (2022). A meta-analysis of multicultural education paradigm in Indonesia. *Heliyon*, 8(1), e08828. <https://doi.org/10.1016/j.heliyon.2022.e08828>
- Johnson, D. W., & Johnson, R. T. (1993). *Positive interdependence: The heart of cooperation*. Interaction Book Company.
- Khaerunisa, L., Hakim, Z. R., & Taufik, M. (2022). Pengembangan media monopoli dengan tema Indahnya Keragaman di Negeriku pada mata pelajaran IPS kelas IV. *Primary: Jurnal Pendidikan Guru Sekolah Dasar*, 11(4), 1132–1148. <https://doi.org/10.33578/jpfkip.v11i4.8567>
- Kusumawati, H. (2017). *Indahnya Keragaman di Negeriku: Buku Tematik Terpadu Kurikulum 2013 (Tema 7), Buku Siswa SD/MI Kelas IV*. Kementerian Pendidikan dan Kebudayaan.
- Li, M., Ma, S., & Shi, Y. (2023). Examining the effectiveness of gamification as a tool promoting teaching and learning in educational settings: A meta-analysis. *Frontiers in Psychology*, 14, 1253549. <https://doi.org/10.3389/fpsyg.2023.1253549>
- Luo, H. (2023). Editorial: Advances in multimodal learning: pedagogies, technologies, and analytics. *Frontiers in Psychology*, 14, 1286092. <https://doi.org/10.3389/fpsyg.2023.1286092>
- Maharani, D. S., Indrawadi, J., & Amri, U. (2021). Using Teams Games Tournament (TGT) model associated with snakes and ladder games media to improve students' learning activities at grade V of SDN 13 Kapalo Koto, Padang. *Primary: Jurnal Pendidikan Guru Sekolah Dasar*, 10(4), 1069–1078. <https://doi.org/10.33578/jpfkip.v10i4.8474>
- Mardhiah, M., Ginting, D., Mumfangati, T., Meisuri, M., Fatmawati, E., Jannah, M., Siyono, S., Haris, M., & Saputra, N. (2024). Internalization of multicultural education in improving students' multicultural competence. *Journal of Education and Health Promotion*, 13, 204. https://doi.org/10.4103/jehp.jehp_1206_23
- Maulidia, I., & Muthi, I. (2025). Efektivitas penggunaan media pembelajaran interaktif berbasis multimedia dalam meningkatkan minat belajar matematika pada siswa SD. *Mutiara: Jurnal Penelitian dan Karya Ilmiah*, 3(4), 10–24. <https://doi.org/10.59059/mutiara.v3i4.2624>
- Mayer, R. E. (2009). *Multimedia learning* (2nd ed.). Cambridge University Press.

- Merkuri, Y. G., Aulia, S. S., & Bin Nasim, M. T. (2025). Board games and Pancasila education: Teachers' perspectives in supporting global diversity. *Jurnal Civics: Media Kajian Kewarganegaraan*, 22(1), 119–133. <https://doi.org/10.21831/jc.v22i1.1350>
- Nur Janah, S. N. T., Finali, Z., & Puspitaningrum, D. A. (2023). Pengembangan media pembelajaran monopoli sosial budaya (MOSIDA) berbasis kearifan lokal Jember. *Elementary School Journal PGSD FIP Unimed*, 13(4), 443. <https://doi.org/10.24114/esjpgsd.v13i4.48496>
- Othman, M. K., Mat, R., & Sim, K. C. (2025). A systematic review of paper-based and digital board games for collaborative science learning. *Review of Education*, 13(3), e70107. <https://doi.org/10.1002/rev3.70107>
- Paas, F., & Sweller, J. (2012). An evolutionary upgrade of cognitive load theory: Using the human motor system and collaboration to support the learning of complex cognitive tasks. *Educational Psychology Review*, 24(1), 27–45. <https://doi.org/10.1007/s10648-011-9179-2>
- Putri, N. A., Suarman, & Syabrus, H. (2023). Application of team game tournament (TGT) as a cooperative learning model to increase students' learning motivation of class X OTKP in business economics learning subjects at SMK Telkom Pekanbaru. *Jurnal PAJAR (Pendidikan dan Pengajaran)*, 7(1), 244–257. <https://doi.org/10.33578/pjr.v7i1.9040>
- Rahayu, T., Annissa, M., Nakita, Tobing, R. D., Sinaga, H., Sinulingga, S. D. N., & Yunita, S. (2025). Globalisasi dan tantangan identitas nasional: Studi Kebudayaan Indonesia. *JUPANK (Jurnal Pancasila dan Kewarganegaraan)*, 5(2), 842–854. <https://doi.org/10.36085/jupank.v5i2.8301>
- Ryan, R. M., & Deci, E. L. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary Educational Psychology*, 61, 101860. <https://doi.org/10.1016/j.cedpsych.2020.101860>
- Sa'id, M., & Aini, S. N. (2024). Pengaruh model pembelajaran Team Games Tournament (TGT) menggunakan media monopoli terhadap hasil belajar siswa SMK Miftahul Huda. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, 8(2), 1785–1793. <https://doi.org/10.31004/cendekia.v8i2.3314>
- Safrizal, Selpia, R., Arafah, K., & Sulaimon, J. T. (2026). Game-based learning intervention: The effect of Baamboozle on science learning interest in primary education. *Primary: Jurnal Pendidikan Guru Sekolah Dasar*, 15(1), 15–26. <https://doi.org/10.33578/jpfkip.v15i1.15-26>
- Sakundari, K. I., & Rizqi, H. Y. (2024). Keefektifan model pembelajaran Team Games Tournament (TGT) berbantuan monopoli terhadap kemampuan berhitung dan kolaborasi siswa kelas 2 SD. *Jurnal Basicedu*, 8(1), 601–614. <https://doi.org/10.31004/basicedu.v8i1.6995>
- Sirichuenvichit, W., & Prarakijjak, W. (2025). Developing social skills for cohabiting in a multicultural society through the board game Religio. *Journal of Education and Learning*, 14(5), 199–208. <https://doi.org/10.5539/jel.v14n5p199>
- Skinner, B. F. (1974). *About behaviorism*. Alfred A. Knopf.
- Slavin, R. E. (2015). *Cooperative learning: Teori, riset, dan praktik* (Zubaedi & Nurulita, Trans.). Nusa Media.
- Sousa, C., Rye, S., Sousa, M., Torres, P. J., Perim, C., Mansuklal, S. A., & Ennami, F. (2023). Playing at the school table: Systematic literature review of board, tabletop, and other analog game-based learning approaches. *Frontiers in Psychology*, 14, 1160591. <https://doi.org/10.3389/fpsyg.2023.1160591>
- Sugiyono. (2022). *Metode Penelitian & Pengembangan*. Alfabeta.
- Susanto, A. H., Wulandari, M. D., & Darsinah. (2024). Optimalisasi pembelajaran anak usia sekolah dasar melalui pemahaman teori perkembangan kognitif Jean Piaget. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, 9(4), 689–706. <https://doi.org/10.23969/jp.v9i4.17102>
- Suwarni, N. (2019). Penerapan model pembelajaran kooperatif tipe Teams Games Tournaments (TGT) untuk meningkatkan hasil belajar PPKn siswa kelas 1 SD Negeri 004 Teratak Buluh. *Jurnal PAJAR (Pendidikan dan Pengajaran)*, 3(1), 175–181. <https://doi.org/10.33578/pjr.v3i1.6830>
- Sweller, J. (2011). Cognitive load theory. In J. P. Mestre & B. H. Ross (Eds.), *The psychology of learning and motivation: Cognition in education* (Vol. 55, pp. 37–76). Academic Press.
-



- Tondok, M. S., Suryanto, S., & Ardi, R. (2024). Building bridges in diverse societies: A meta-analysis of field experimental cooperative learning studies on intergroup relations in educational settings. *Societies*, 14(11), 221. <https://doi.org/10.3390/soc14110221>
- Torres-Munares, M. S., Hurtado-Flores, A. C., & Carrera-Salas, E. A. (2024). Gamification applied with the SOAR study method for time management of university students. *Cogent Education*, 11(1), 2398851. <https://doi.org/10.1080/2331186X.2024.2398851>
- Vrcelj, A., Hoić-Božić, N., & Holenko Dlab, M. (2023). Use of gamification in primary and secondary education: A systematic literature review. *International Journal of Educational Methodology*, 9(1), 13–27. <https://doi.org/10.12973/ijem.9.1.13>
- Wibowo, N. (2021). The effectiveness of multicultural based Indonesian teaching materials to improve critical thinking skills. *Jurnal PAJAR (Pendidikan dan Pengajaran)*, 5(2). <https://doi.org/10.33578/pjr.v5i2.8287>
- Zhu, Z., & Wu, X. (2025). Integration of sensor technology in education to improve learning outcomes. *Sensors and Materials*, 37(9), 4115–4126. <https://doi.org/10.18494/SAM5666>
- Zufriady, Al Fajar, B., Sari, I. K., Rizka, M., Rahman, F., Radini, Desmita, I., & Balqis, A. (2025). Development of multicultural instruments for elementary school teachers in arts, culture, and crafts learning: Instrument validation analysis. *Jurnal PAJAR (Pendidikan dan Pengajaran)*, 9(5), 605–616. <https://doi.org/10.33578/pjr.v9i5.318>