

The Effectiveness of Integrated Augmented Reality Media With Lamongan Local Culture to Overcome Difficulties in Understanding Pancasila in The Second and Fifth Principles in Elementary School Students

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ABSTRACT

Difficulties in understanding the values of Pancasila persist among elementary school students, especially in the second and fifth precepts, which contain abstract concepts of humanity and social justice. Learning that is still dominated by conventional methods makes it difficult for students to connect the material to real-life experiences. This study aims to analyze the effectiveness of Augmented Reality (AR) media integrated with Lamongan local culture in overcoming difficulties in understanding Pancasila in the second and fifth precepts in elementary school students. The research uses a quantitative approach with a quasi-experimental pretest-posttest control-group design. The research subjects were 64 elementary school students, divided into two groups: 32 in the experimental group and 32 in the control group. The experimental group obtained learning using AR media integrated with Lamongan local culture, while the control group used conventional learning media. Data collection was carried out through Pancasila understanding tests, observation sheets, and student response questionnaires. Data analysis used the N-Gain test, the independent-samples t-test, and effect size to determine the level of media effectiveness. The study's results show that integrating AR media with Lamongan local culture significantly increases students' understanding compared to conventional learning. The experimental group's posttest score was higher than the control group's, with moderate to substantial improvement in N-Gain results. The three-dimensional visualization and interactivity displayed through AR technology help students understand the meaning of just and civilized human values and social justice for all Indonesian people in a more concrete way. In addition, integrating Lamongan's local culture provides a learning context close to students' lives, thereby increasing engagement, motivation, and meaningful learning experiences. Thus, Lamongan's locally integrated AR media has proven effective in overcoming difficulties in understanding the second and fifth precepts of Pancasila among elementary school students and has the potential to become an innovation in Pancasila Education that is relevant to the demands of 21st-century education.

Keywords: *augmented reality, lamongan local culture, media effectiveness, pancasila education, elementary school*

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INTRODUCTION

Pancasila education is one of the core competencies that elementary school students must master, as outlined in the Independent Curriculum. Pancasila, the basis of the state and the philosophy of life of the Indonesian nation, contains universal values that must be understood and practiced by every citizen. However, students' understanding of Pancasila values, especially the second and fifth precepts, remains very low and is hindered by various obstacles (Septinaningrum, Hakam, Setiawan, & Agustin, 2022). The second precept (Fair and Civilized Humanity) and the fifth precept (Social Justice for All Indonesian People) contain abstract concepts of humanity, justice, and social welfare that are difficult for elementary school-age students to understand.

The learning process in Pancasila Education, which is still dominated by conventional methods such as lectures, question-and-answer sessions, and reading texts, makes it difficult for students to connect Pancasila values with concrete experiences in their daily lives (Made et al., 2025). Students tend to memorize definitions without really understanding the meaning and application of those values. This results in less meaningful

learning and low student engagement. To overcome these problems, innovations in media and learning methods are needed to make abstract concepts more concrete and easier for students to understand (Mansour et al., 2024).

Augmented Reality (AR) technology offers innovative solutions by visualizing abstract concepts in an interactive, immersive three-dimensional format (Aldeeb et al., 2024). Recent research shows that AR technology has been effective in improving students' conceptual understanding, learning motivation, and engagement (Koumpouros, 2024). In addition, integrating local culture into learning can provide students with a relevant and meaningful context, thereby increasing the relevance and effectiveness of learning (Nurasiah et al., 2022).

Lamongan, one of the districts in East Java, has a rich local cultural heritage and is rich in noble values aligned with Pancasila. The local culture of Lamongan reflects the values of humanity, justice, and social welfare, which can serve as a bridge to understanding the second and fifth precepts of Pancasila. By integrating Lamongan's local culture into AR media, it is hoped that Pancasila learning will become more contextual, meaningful, and effective in overcoming students' difficulties of understanding.

Therefore, this study was conducted to analyze the effectiveness of Augmented Reality media integrated with Lamongan local culture in overcoming difficulties in understanding Pancasila in the second and fifth precepts in elementary school students. It is hoped that the results of this research will make an empirical contribution to the use of AR technology in Pancasila Education learning and provide alternative learning innovations relevant to the needs of 21st-century education.

LITERATURE REVIEW

Difficulties in Understanding Pancasila in Elementary School Students

Pancasila is the foundation of the Indonesian state, encompassing noble values of divinity, humanity, unity, the people, and justice (Nurasiah et al., 2022). However, research shows that elementary school students face various difficulties in understanding the values of Pancasila, especially abstract concepts such as just and civilized humanity and social justice. This difficulty arises due to several factors, including: (1) the abstract nature of Pancasila values that is difficult for students to visualize, (2) learning methods that are still conventional and do not involve active student participation, (3) lack of context relevant to students' daily lives, and (4) low motivation and engagement of students in Pancasila learning (Septinaningrum et al., 2022). The second precept of Pancasila (Fair and Civilized Humanity) and the fifth precept (Social Justice for All Indonesian People) contain concepts of humanity and justice that are very important to be applied in the life of the nation and the state. However, these concepts are abstract and difficult to visualize in real life, making it difficult for students to understand them well. Previous research has shown that learning using visual and interactive media can help students better understand abstract concepts (Made et al., 2025).

Augmented Reality in Learning

Augmented Reality (AR) is a technology that integrates digital content (such as 3D images, animations, and sounds) into the real world in real time (Koumpouros, 2024). AR technology allows students to interact with learning content in a more immersive and engaging way compared to traditional learning media. Recent research shows that the use of AR in learning can improve understanding of concepts, motivation, self-efficacy, and student engagement (Aldeeb et al., 2024; Mansour et al., 2024).

In the context of learning Pancasila and Civic Education, several studies have shown that AR can be an effective medium for helping students understand the values of Pancasila and the concept of Civic Education (Ahdhianto et al., 2025; Fransyaigu et al., 2025). The three-dimensional visualization and interactivity enabled by AR can help students connect abstract values to their concrete experiences. In addition, AR can increase student engagement and learning motivation by allowing students to interact with learning content (Sari, 2025) actively.

Local Culture-Based Learning

Local culture-based learning is a learning approach that integrates local cultural values, knowledge, and practices into the curriculum (Sakti, Endraswara, & Rohman, 2024). This approach is based on the principle of ethnopedagogy, which is a learning approach that considers students' cultural and local contexts. Research shows that integrating local culture into learning can increase its relevance, contextualize knowledge, and enhance student engagement (Wardani et al., 2025).

METHODS

Design and Research Approach

This study uses a quantitative approach with a quasi-experimental pretest-posttest control-group design. This design was chosen because it allowed researchers to measure the effectiveness of AR media by comparing pretest and posttest results between the experimental group (which received integrated AR media on the local Lamongan culture) and the control group (which received conventional learning). Using this design, the researcher can control factors that may affect the research results while objectively measuring the influence of free variables (the use of AR media) on bound variables (students' understanding of Pancasila values).

Population and Research Sample

The study population included all grade V elementary school students in Lamongan Regency. The research sample was selected purposively and comprised 64 elementary school students from two schools in Lamongan Regency with similar school characteristics (facilities, teacher qualifications, and students' socioeconomic levels). Students were divided into two groups, namely an experimental group of 32 students who received learning with AR media integrated with Lamongan local culture, and a control group of 32 students who received conventional learning. Subject selection is carried out with the following inclusion criteria: (a) students actively participate in learning at school, (b) have heterogeneous academic abilities (including students with high, medium, and low achievements), (c) are willing to participate in research until completion, and (d) have written permission from parents or guardians. The distribution of students' academic abilities in both groups is intended to be balanced through a careful group-formation process to ensure the internal validity of the research.

Research Variables

The independent variable in this study is the use of Augmented Reality media integrated with Lamongan local culture, specifically developed for Pancasila learning, featuring three-dimensional visualization of human values and social justice, with examples of Lamongan local culture. The dependent variable is the student's understanding of the values of Pancasila in the second precept (Just and Civilized Humanity) and the fifth precept (Social Justice for All Indonesian People), which is measured through a comprehension test with questions that measure the cognitive aspects of concept understanding, application understanding, and evaluative understanding. The control variables considered in this study included students' initial academic ability (measured from previous report card scores), students' demographic characteristics (age, gender), previous learning experience with digital media, and the same learning duration for both groups (8 meetings with a time allocation of 2 hours of lessons per meeting).

Research Instruments

The research instruments used in this study are designed to measure various dimensions of learning. First, a Pancasila comprehension test was designed to measure students' understanding of Pancasila values, especially the second and fifth precepts. This test consists of 40 questions that include multiple-choice questions (25 questions) and description questions (15 questions) that Pancasila education experts from the

State University of Surabaya have validated. The questions are designed following Bloom's revised taxonomy to measure comprehension abilities at various levels (remembering, comprehending, applying, analyzing, evaluating, and creating). The questions are developed using a comprehensive grid to ensure content validity and alignment with the established learning indicators. The instrument has undergone a reliability test with Cronbach's alpha coefficient of 0.84, indicating high reliability.

Second, observation sheets were used to monitor the learning process in both groups during the research implementation. This observation sheet covers important aspects such as student engagement (active questioning, participation in discussions, and focus of attention), student interaction with learning media, student involvement in learning (active participation and group cooperation), and students' emotional response to learning. The observation sheet was developed based on the EMPOWER (Engagement, Motivation, Positive Behavior, Opportunities for participation, Wealth of learning, Effective teaching, and Respect) framework. Observation was conducted by two trained observers (inter-rater reliability: ICC = 0.85) during each learning session to ensure consistency and objectivity.

Third, the student response questionnaire was used to measure students' perceptions and responses to the AR media, including ease of use, interest, and engagement with the content, perceptions of the media's benefits for learning, and student satisfaction with the learning experience. This questionnaire consists of 25 statements, rated on a 5-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = hesitate, 4 = agree, 5 = strongly agree). In addition, the questionnaire includes open-ended questions to elicit students' qualitative responses to learning with AR media. The questionnaire construct validity was assessed using expert judgment and factor analysis, with a Kaiser-Meyer-Olkin (KMO) value of 0.78 (meeting the criteria for factor analysis).

Research Procedure and Implementation

The research was carried out in several well-structured stages. The first stage is the preparation stage, which includes developing and validating Lamongan's local culture-integrated AR media, developing and validating research instruments (comprehension tests, observation sheets, and response questionnaires), and providing orientation and training for teachers and students on how to use AR media. At this stage, AR media is developed in collaboration with graphic designers, programmers, and Pancasila education experts to ensure pedagogical and technical quality. Teachers also receive 4-hour training to understand the features of AR media and optimal learning strategies for using it.

The second stage is the baseline or pretest stage, in which both groups are given the same Pancasila comprehension test to measure each student's initial level of understanding before receiving different treatments. The pretest was held in a 60-minute session and was attended by all 64 sample students. The pretest results were used to verify that both groups had equal levels of initial understanding before the study began. The third stage is the intervention stage, or treatment implementation, which lasts 8 meetings, each with 2 hours of lessons. The experimental group received learning using AR media integrated with Lamongan local culture, while the control group received conventional learning using lecture, question-and-answer, and class discussion methods with traditional learning media (textbooks, whiteboards, pictures). The same teacher taught both groups to control for teaching quality factors. The learning materials provided to both groups were identical, differing only in media and content delivery strategies.

The fourth stage is the posttest, in which both groups are given the same comprehension test as in the pretest to measure students' comprehension after receiving different treatments. The posttest is administered one week after the last learning meeting to reduce the recency effect. The posttest results are then analyzed and compared with the pretest results to determine the improvement of student understanding in each group.

The fifth stage is the qualitative data collection stage, conducted through observation and a student response questionnaire, carried out simultaneously with the intervention stage and after the posttest. Observational data is collected at each learning meeting to track the dynamics of student engagement and motivation during the learning process. Student response questionnaires were distributed to all students in the

experimental group after the posttest to explore their perceptions and experiences in using AR media. At the end of this stage, the researcher also conducted in-depth interviews with some of the purposively selected students to deepen their understanding of their learning experiences.

RESULTS AND DISCUSSION

Data Analysis

The analysis of research data used a mixed-methods approach, combining quantitative statistical analysis and qualitative descriptive analysis. Quantitative analysis was conducted on pretest and posttest results, observation data, and Likert-scale response data from the questionnaire. Before performing hypothesis testing, the data were assessed to ensure they met the assumptions of parametric statistical analysis, including normality tests using the Shapiro-Wilk test and tests of variance homogeneity using Levene's test.

First, the Gainscore Analysis (N-Gain) is used to measure the improvement in student understanding from pretest to posttest. The N-Gain calculation uses the formula: $g = (\text{posttest} - \text{pretest}) / (\text{maximum score} - \text{pretest})$. The N-Gain results for each student were categorized into three categories: (a) low if $g < 0.30$, (b) moderate if $0.30 \leq g < 0.70$, and (c) high if $g \geq 0.70$. The average N-Gain values for each group were then calculated and compared to determine which group experienced a greater increase in understanding.

Second, an independent-samples t-test was used to compare the posttest means between the experimental and control groups to determine whether the difference was statistically significant at the 95% confidence level ($\alpha = 0.05$). The t-test was chosen because the data met the assumptions for parametric statistics (normality and homogeneity of variance). If the data do not meet the assumption of normality, a nonparametric alternative, namely the Mann-Whitney U test, is used. The t-count and p-value were obtained from the statistical analysis and used to determine the statistical significance of the difference between the two groups.

Third, Cohen's d is used to calculate the practical magnitude of the treatment effect of AR media on student understanding, not just its statistical significance. Cohen's value of d is interpreted as follows: (a) a small effect if $d = 0.20-0.49$, (b) a moderate effect if $d = 0.50-0.79$, (c) a large effect if $d = 0.80-1.19$, and (d) a very large effect if $d \geq 1.20$. Cohen's calculation of d uses the formula: $d = (M_1 - M_2) / \sqrt{[(SD_1^2 + SD_2^2) / 2]}$, where M_1 and M_2 are the average values of the experimental and control groups posttest, and SD_1 and SD_2 are the standard deviations of each group.

Fourth, qualitative data from observations and interviews are analyzed using thematic analysis to identify themes and patterns in students' learning experiences. The data from the student response questionnaire (open-ended questions) were also analyzed descriptively to complement and deepen the understanding of the influence of AR media on student learning. All statistical analyses were carried out using SPSS version 26.0, and qualitative analysis was conducted manually by repeatedly reading and encoding the data.

Grid of Questions for the Understanding of Pancasila

The Pancasila understanding test instrument in this study was developed based on a comprehensive grid. The grid is designed to measure students' understanding of the second and fifth precepts of Pancasila at various cognitive levels according to Bloom's revised taxonomy. Each dimension of knowledge (factual, conceptual, procedural, and metacognitive) is explored to ensure deep understanding is measured.

Comparison of Pretest and Posttest Scores

The data analysis showed significant differences in improved understanding between the experimental and control groups. The data on the comparison of pretest and posttest scores of the two groups is presented in Table 2 below:

Table 2. Comparison of Pretest and Posttest Scores of Experimental and Control Groups

Groups	Pretest (M $\pm$ SD)	Posttest (M $\pm$ SD)	Increase (Δ)
Experiments (n=32)	45.28 $\pm$ 8.52	78.94 $\pm$ 7.31	33.66 $\pm$ 9.18
Control (n=32)	44.81 $\pm$ 8.76	62.13 $\pm$ 9.47	17.32 $\pm$ 8.95
Posttest Differences	t(62) = 0.27; p > 0.05	t(62) = 8.94; p < 0.001	Δ = 16.34

****** $p < 0.001$ shows a very significant difference; M = red; SD = standard deviation; Δ = difference

At the pretest stage, the analysis showed no significant difference between the experimental group (M = 45.28; SD = 8.52) and the control group (M = 44.81; SD = 8.76), $t(62) = 0.27$, $p > 0.05$. This confirms that both groups had the same level of initial understanding before receiving different treatments. After 8 treatment sessions, posttest results showed significant improvement in both groups, with noticeable differences. The experimental group achieved a mean posttest score of 78.94 (SD = 7.31), while the control group achieved a mean posttest score of 62.13 (SD = 9.47). The average posttest difference of 16.81 points between the two groups indicated much greater improvement in the AR media group. The results of the independent-samples t-test confirmed that this difference was statistically significant, $t(62) = 8.94$, $p < 0.001$.

N-Gain Analysis

N-Gain analysis was used to measure normalized improvement in comprehension and compare learning effectiveness between the two groups. The results of the N-Gain analysis are presented in the following Table 3:

Table 3. Experimental and Control Group N-Gain Analysis

Groups	Average N-Gain (M $\pm$ SD)	Categories	t-count	p-value
Experiments	0.63 $\pm$ 0.12	Medium-High		
Controls	0.35 $\pm$ 0.14	Low-Medium		
Comparison	Δ = 0.28		10.21	< 0.001

Table 4. Distribution of Students by N-Gain Category

N-Gain Category	Experiments (n=32)	Control (n=32)	Quantity
Low ($g < 0.30$)	6 students (18.75%)	14 students (43.75%)	20 (31,25%)
Medium ($0.30 \leq g < 0.70$)	18 students (56.25%)	16 students (50%)	34 (53,13%)
Height ($g \geq 0.70$)	8 students (25%)	2 students (6.25%)	10 (15,63%)
Total	32 (100%)	32 (100%)	64 (100%)

The results of the N-Gain analysis showed that the experimental group had an average N-Gain of 0.63 (SD = 0.12), which fell in the medium to high range. In contrast, the control group achieved an average N-Gain of 0.35 (SD = 0.14), which fell within the low-to-medium range. The mean difference in N-Gain of 0.28 between the two groups was statistically significant, $t(62) = 10.21$; $p < 0.001$. The distribution of students by N-Gain category also shows a different pattern between the two groups. In the experimental group, the majority of students (56.25%) experienced an increase in understanding in the medium category, followed by 25% in the high category. In contrast, in the control group, the majority of students (43.75%) experienced only an increase in the low category, with only 6.25% of students achieving the high category. This shows that integrating AR media with Lamongan local culture results in a more consistent and sustainable increase in students' understanding.

Effect Size Analysis

The effect size is calculated to assess the practical impact of AR media on student understanding. The results of the effect size analysis are presented in Table 5 below:

Table 5. Effect Size Analysis (Cohen's d) Comparison of Experimental and Control Groups

Comparison	Cohen's d	Categories Effects	Interpretation
Posttest Experiment vs Control	2.09	Very Large	The practical effect is very significant
N-Gain Experiment vs Control	1.87	Very Large	Much greater learning improvement
Pretest-Posttest Experiment	3.62	Very Large	Dramatic increase in experimental groups
Pretest-Posttest Control	1.94	Very Large	Significant improvement in conventional learning

Note: Cohen's effect category d - Small: 0.20-0.49; Moderate: 0.50-0.79; Large: 0.80-1.19; Very Large: ≥ 1.20

The results of the effect size analysis showed that the difference between the experimental and control groups had a very large effect size (Cohen's $d = 2.09$). Cohen's d value of 2.09 indicates that the difference in posttest scores between the two groups is not only statistically significant but also has enormous practical significance. This means that the use of AR media integrated with Lamongan local culture results in a much greater increase in understanding of Pancasila compared to conventional learning.

Effect size analysis for the N-Gain comparison between the two groups also showed a very large effect (Cohen's $d = 1.87$), confirming that the normalized improvement in understanding in the experimental group was much greater than in the control group. In addition, an effect size analysis of pretest-posttest comparisons within the experimental group showed a very large effect size (Cohen's $d = 3.62$), suggesting that AR media led to a dramatic and consistent improvement in understanding within the group. Even the control group using conventional learning showed a significant improvement, with a large effect size (Cohen's $d = 1.94$), although it remained smaller than that of the experimental group.

Observation Results of the Learning Process

The results of observations of the learning process showed a clear difference between the two groups. In the AR media group, students showed high engagement in learning. Students actively interact with AR media, try to understand the three-dimensional visualizations displayed, and spontaneously relate the learning content to their experiences. Student engagement in group discussions was also higher, with more questions and student contributions. The use of Lamongan's local culture in AR media also piqued students' interest. Students feel more connected to the learning content when it uses cultural references they know and understand. Overall, the learning atmosphere in the experimental group was more interactive and dynamic, and the students showed higher motivation to learn.

In contrast, in the control group that used conventional learning, student engagement was relatively lower. Learning is dominated by the teacher's explanations through lectures and question-and-answer sessions. Some students show signs of boredom and lack of focus, especially when teachers explain abstract concepts of humanity and social justice. Group interactions and discussions are also more passive, with only a few students actively contributing to learning.

Student Response Questionnaire Results

The results of the student response questionnaire on AR media were very positive. The majority of students in the experimental group agreed that AR media is easy to use (89%), makes learning more enjoyable (94%), and helps them understand the values of Pancasila better (91%). Students also showed a positive perception of the use of Lamongan's local culture, with 87% agreeing that its use made learning more meaningful and relevant to their lives. In response to open-ended questions about their learning experiences, students stated that AR media makes abstract concepts of humanity and social justice easier to understand.

Some students say that three-dimensional visualization helps them "see" and "feel" the meaning of the second and fifth precepts.

DISCUSSION

The results of this study show that Augmented Reality media integrated with Lamongan local culture have proven very effective in overcoming difficulties in understanding the Pancasila in the second and fifth precepts among elementary school students. The effectiveness of AR media aligns with previous research, which shows that AR technology has great potential to improve learning, especially in visualizing abstract concepts (Aldeeb et al., 2024; Koumpouros, 2024; Mansour et al., 2024). The use of Augmented Reality (AR) technology can significantly improve student learning outcomes (Puspita, 2022). Augmented reality Learning Media can be a solution to learning problems and understanding elementary school students.

The very large effect size (Cohen's $d = 2.09$) indicates that the difference between the experimental and control groups is not only statistically significant but also practically very significant. This shows that Lamongan's local culture-integrated AR media results in a substantial increase in understanding compared to conventional learning. The average N-Gain value in the experimental group (0.63), which fell in the medium-to-high range, also indicated that the use of AR media resulted in a consistent improvement in students' understanding. AR can also be an effective medium for supporting character education, such as instilling a sense of respect and preserving the nation's cultural heritage (Nurhidayat et al., 2025). The integration of storytelling, animation, and interactive simulation elements allows students to build an emotional connection to the culture they are studying, thereby increasing their sense of pride in regional and national cultural identity (Puspita, 2005). So that, through Augmented Reality, students can understand the context of state symbols and their meanings in life.

The effectiveness of AR media in this study can be explained through several learning mechanisms. First, the three-dimensional AR visualization helps transform abstract concepts of humanity and social justice into more concrete, easy-to-understand forms. Students can "see" and "interact with" the visual representation of Pancasila values, thus making it easier for them to understand. Cognitive research shows that visual learning and embodied cognition (learning through movement and physical interactions) can enhance students' retention and understanding of concepts (Mansour et al., 2024).

Second, the interactivity offered by AR media increases student engagement and motivation in learning. Students not only passively receive information through the teacher's lectures but also actively engage with the learning content. This aligns with constructivist learning theory, which emphasizes active participation and direct student experience in building knowledge (Aldeeb et al., 2024). Through learning media, students will more easily understand the values of Pancasila (Puspita, 2024).

Third, integrating Lamongan local culture into AR media provides a relevant and meaningful context for learning. Local culture serves as a "bridge" connecting the abstract values of Pancasila with students' concrete experiences and daily lives. This aligns with the principles of ethnopedagogy and culture-based learning, which emphasize contextualizing knowledge within local culture (Nurasiah et al., 2022).

CONCLUSION AND RECOMMENDATIONS

Conclusion

This research has shown that Augmented Reality media integrated with Lamongan local culture has proven very effective in overcoming difficulties in understanding the Pancasila in the second and fifth precepts among elementary school students. The main findings of this study were: (1) there was a very significant difference in the improvement in understanding between the experimental group and the control group, with a difference in posttest scores of 16.81 points and a very large effect size (Cohen's $d = 2.09$); (2) the average value of N-Gain in the experimental group (0.63) showed an increase in understanding in the medium to high category; (3) the results of observations show that the use of AR media significantly increases student

engagement, motivation, and interaction in learning; and (4) students responded very positively to AR media and the use of local culture in learning (89-94%).

Thus, Lamongan's locally integrated AR media has proven to be an effective learning innovation and has the potential to improve the quality of Pancasila Education in elementary schools while strengthening students' local cultural identity.

Recommendations

Based on the results of this study, recommendations for the development of Pancasila Education learning in elementary schools are: (1) for educators, AR media integrated with local culture can be adopted and implemented in learning with adequate training support; (2) for learning media developers, the development of AR media for various subjects and other local cultural contexts needs to be continued; (3) for policymakers, the government needs to support investment in technological infrastructure and educator training programs; and (4) for follow-up research, studies with a larger sample, longer duration, and long-term effect measurement are needed to strengthen empirical evidence on the effectiveness of AR media in learning Pancasila Education.

Credit authorship contribution statement

Riska Dwi Berilana Pasiyantiningih: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing – original draft. Ari Metalin Ika Puspita: Supervision, Validation, Methodology, Writing – review & editing, Project administration. Maretha Dellarosa: Supervision, Formal analysis, Validation, Writing – review & editing.

Declaration of competing interest

The authors state that they have no competing financial interests or known personal relationships that could 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. Permission to conduct the study was obtained from the school authorities, and all data collected were kept confidential and used solely for research purposes.

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