Vol. 15, No. 01, pp. 375-387, 2025 DOI: 10.23960/jpp.v15i1.pp375-387

Jurnal Pendidikan Progresif

e-ISSN: 2550-1313 | p-ISSN: 2087-9849

http://jurnal.fkip.unila.ac.id/index.php/jpp/

Development of Augmented Reality-Based Interactive Learning Environment for Enhancing Learning Outcomes of Fifth-Grade Students on Indonesian Cultural Diversity

Novita Wulan Sari*, & Kurotul Aeni

Elementary School Teacher Education, Universitas Negeri Semarang, Indonesia

*Corresponding email: novitawulan77@students.unnes.ac.id

Received: 27 February 2025 *Accepted: 09 March 2025* *Published: 19 April 2025*

Abstract: Development of Interactive Learning Environment Based on Augmented Reality to Improve Learning Outcomes of Grade V Students on the Material of Indonesian Cultural Diversity. **Purpose:** This study was aimed at creating an interactive learning environment by utilizing Augmented Reality (AR) technology to boost the enthusiasm and learning outcomes of fifth grade students of SDN Pagendisan, Pati Regency, on the subject of Pancasila Education, specifically on the theme of Indonesian Cultural Diversity. **Methods:** This study used a Research and Development (R&D) approach, using the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model to develop. **Findings:** The developed learning tools include AR-integrated flashcards that contain 3D elements such as traditional houses, traditional clothing, and regional music. Evaluation based on material experts and media experts showed high media suitability, with an average feasibility score of 89.5. The pilot test conducted with 28 grade 5 primary school students showed a significant improvement in terms of motivation and learning outcomes. Statistical analysis using t-test indicated a significant difference between pretest and posttest scores ($p<0.05$), with an average increase in learning outcomes of 0.75 based on the n-Gain test. **Conclusion:** This study concludes that AR-based learning tools are effective in improving student motivation and learning outcomes, cultivating more dynamic and interesting learning experiences.

Keywords: augmented reality, learning outcomes, motivation, pancasila education.

To cite this article:

Sari, N. W., & Aeni, K. (2025). Development of Augmented Reality-Based Interactive Learning Environment for Enhancing Learning Outcomes of Fifth-Grade Students on Indonesian Cultural Diversity. *Jurnal Pendidikan Progresif*, *15*(1), 375-387. doi: 10.23960/jpp.v15i1.pp375-387.

INTRODUCTION

Education is a planned and directed effort to support the development of children's potential and abilities, so that they can be useful both as individuals and members of society. This process involves the selection of appropriate materials, activity strategies and techniques (Syafril & Zein, 2019: 33). Education is also a conscious effort to nurture human potential, both physically and mentally, to help individuals achieve their life goals in a more structured way (Yahya, 2020: 14).

Law of the Republic of Indonesia No. 20 of 2023 article 1 paragraph (1) defines education as a conscious and planned effort in order to create an atmosphere and learning process to ectively develop the potential of students in religious spirituality, self-control, noble character, intelligence, and skills needed in the future in society, nation, and state. This includes the development of religious spiritual values, self-discipline, character, intelligence, moral integrity, and skills needed for self-growth, community

contribution, and the progress of the nation and state. In addition, article 3 of the National Education System Law contains the objectives of national education, namely to foster abilities build dignified character in relation to the intellectual life of the nation. The purpose of national education according to (Rusmaini, 2014) is to optimize students' abilities in order to create people who have faith and piety towards God Almighty, are ethical, healthy, knowledgeable, independent, inventive, and become democratic and responsible people.

Based on some of these explanations, it can be concluded that education is a directed and organized effort that aims to encourage the growth of children's potential and skills, both at the individual level and as part of a universal social context. The selection of educational materials, strategies and techniques aims to foster physical and mental potential, which enables individuals to achieve their life goals effectively. In addition, education serves to create an active learning environment, helping students develop spiritual character, self-discipline, intelligence, noble morals, and life skills essential for future roles in society.

Education is one of the fields affected by the rapid development of science and technology today. The integration of technology in education helps to create an interactive learning environment that can attract attention and motivate students in learning. Improving the quality of learning is seen in the integration of information and communication technology in education which is able to create more dynamic and interactive learning (Trenggono Hidayatullah et al., 2023).

Examples of technology integration in education such as Augmented Reality (AR), Virtual Reality (VR), and Artificial Intelligence (AI) will enlarge the potential in learning effectiveness and advance innovation in the education system (Timotheou et al., 2023). Augmented Reality is one example of a significant technological advancement that has the potential to create interactive and immersive learning environments (Billinghurst et al., 2014). Traditional methods are considered lacking in stimulating student learning motivation (Herwin et al., 2023). Digital content and physical environments integrated in Augmented Reality are increasingly applied in education to increase student participation, enthusiasm, and academic performance (Radu, n.d.).

Augmented Reality according to Geroimenko (2020: 4) is a technological innovation that has the ability to provide interesting and interactive experiences to users because it integrates digital components into the physical environment. Alan B. Craig (2013: 2) defines AR as a technological innovation that offers users to see virtual objects superimposed on the real world. The conclusion of the two statements is that AR is seen as a technological innovation that integrates virtual components into the real world that can provide interesting and interactive experiences for users.

This research will integrate Augmented Reality technology in learning with the aim of optimizing student motivation and learning outcomes. Research by (Deng et al., 2024) shows that the implementation of AR in an educational environment can strengthen concept understanding, increase student engagement, and increase learning motivation. Augmented Reality (AR) is very beneficial in interactive learning because it significantly fosters student motivation, participation, and concept understanding (Wang, 2024).

The implementation of Augmented Reality in preschool and primary education is considered to be able to increase student enjoyment, engagement, and learning outcomes (Basumatary & Maity, 2023). The interaction that arises from the use of AR technology between teachers and students makes them collaborate and motivated in learning, and is able to create a more interesting learning experience (Bistaman et al., 2018). AR technology is proven to be effective as a learning

medium for elementary school students especially in increasing their engagement, motivation, and understanding through immersive and interactive learning experiences.

There are many subjects in elementary schools that can integrate AR in their learning. One of them can be applied in Pancasila education on the material of Indonesian cultural diversity. Pancasila education according to the Pancasila Education book by the Ministry of Education and Culture (2021) is explained as an effort to instill an understanding and application of Pancasila values in everyday life. Pancasila education is included as character education that helps instill character in students, such as nationalism, responsibility, and tolerance (Nadhif & Putri, 2023).

Research by (Nainggolan et al., 2024) shows that the use of Android-based media applications with Augmented Reality technology is effective for interactive learning processes, especially on Indonesian cultural diversity material. The similarity with this research is the use of Augmented Reality and Indonesian Cultural Diversity material. While the things that distinguish are subjects, research locations, and research focus. This study uses AR-based flashcard media which contains several elements of Indonesian cultural diversity in Pancasila education subjects such as traditional houses, traditional clothing, folk songs, and general information from each region. The research location is in grade V SDN Pagendisan, Pati Regency with a research focus on developing Augmented Reality-based flashcards as interactive media.

Observations were made by researchers located at SDN Pagendisan and conducted interviews with the fifth grade teacher of SDN Pagendisan. The results of the interview show that there are still some students who are difficult to read and write, which directly affects their understanding, especially in Pancasila education. On the other hand, teachers still apply less innovative learning methods, so that the learning that is created is still passive. Teachers have also never used technological innovation as learning media, only using videos and explaining material through PPT. The lack of innovative and technology-supported learning methods will exacerbate student disengagement in learning (Sapulette, 2023).

This research will answer the formulation of problems related to how the design of Augmented Reality-based interactive media development in order to optimize the learning outcomes of fifth grade students in Pancasila Education. The feasibility and effectiveness of the developed media will be known in this study.

Based on this exposure, the research entitled Development of Augmented Reality- Based Learning Media to Improve Learning Outcomes of Grade V Students in the subject of Indonesian Cultural Diversity is important to do so that learning outcomes can be improved through Augmented Reality-based interactive media.

■ METHOD

Participants

The sample of participants in this study amounted to 28 fifth grade students of SDN Pagendisan, Pati Regency, consisting of 13 boys and 15 girls. The technique used in selecting participants was purposive sampling. Purposive sampling was used to ensure that the study focused on a specific group of students involved in learning Pancasila education under the same curriculum and learning situation. This technique was chosen to maintain consistency of research variables and ensure all students have the same educational background and exposure to learning materials (Creswell et al., 2018). This study was conducted by separating students into a small group and a large group, both of which will receive the same treatment. The small group consisted of 6 students with the criteria of 2 upper order students, 2 middle order students, 2 lower order students. The large group consisted of 22 students. The implementation time of this research

is the even semester of the 2024/2025 school year.

Reserach Design and Procedures

This study uses a Research and Development (R&D) approach, using the ADDIE framework (Analysis, Design, Development, Implementation, and Evaluation) to prepare and develop Augmented Reality (AR)-based interactive media for grade five at SDN Pagendisan in Pati Regency. Borg and Gall (1989: 775) define Research and Development as an approach focused on creating and evaluating innovative products. This study did not use a control group because the approach used was a development that had the aim of developing or perfecting learning media and testing its effectiveness (Sugiyono, 2015: 407).

This research follows the ADDIE framework which consists of five sequential stages: Analysis, Design, Development, Implementation, and Evaluation. The ADDIE model is an approach that focuses on analyzing each component in relation to each other in line with the phases (Sezer, et al., 2013: 137). This model was chosen because of its systematic and structured methodology, ensuring comprehensive implementation and assessment at each stage of development. This development research adopted the ADDIE instructional design model to create Augmented Reality (AR)-based interactive media by following the structured steps of the ADDIE model.

The initial stage in ADDIE is Analysis, which is a stage carried out by analyzing needs and identifying problems to define something that

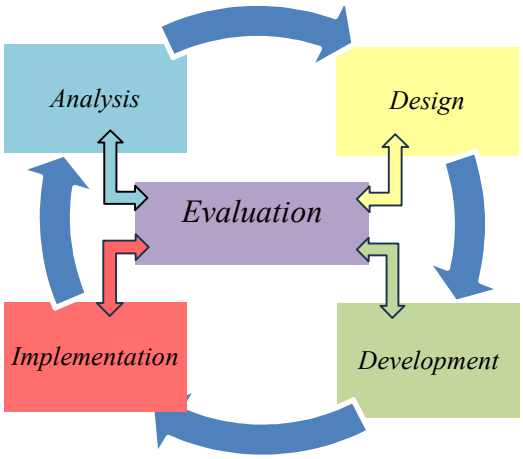


Figure 1. ADDIE model

students will learn (Zef Risal et al., 2022: 52). The needs analysis in this study was carried out by distributing questionnaires with 3 indicators, namely motivation, learning media needs, and student learning preferences. The indicators were taken based on references (Kustandi, 2020: 30-37). The needs questionnaire was also given to teachers from references (Kustandi, 2020: 30-37) with 3 indicators, namely: learning media needs, learning innovation needs, and obstacles in the learning process.

The design stage is also called design. Researchers need to design the development according to what will be researched (Rayanto, 2020: 35). The design stage in this study includes visual design and learning scenarios. Visual design in the form of AR-based flashcards and learning scenarios in the form of teaching modules that will be used in learning practices.

Development is the stage of realizing the design that has been designed by researchers (Zef Risal et al., 2022: 53). The development was

carried out with the help of the Canva application in making flashcards and the Assemblr Edu application to add 3D AR elements. The development of the design was then subjected to expert testing. Expert test through formative evaluation in the form of a validation sheet that has been prepared based on the product produced and expert validators (media experts and material experts). The expert test stage is very important to do with the aim of knowing that the products produced are in accordance with the needs and standards required (Rayanto, 2020: 37).

Implementation is the application stage of the design and development that has been carried out (Zef Risal et al., 2022: 54). The implementation was carried out to fifth grade students of SDN Pagendisan in learning Pancasila Education material on Indonesian Cultural Diversity on January 30, 2025. The last stage is evaluation, where this stage is a process to measure the success of the learning that has been done (Zef Risal et al., 2022: 55). The evaluation stage can be carried out by distributing formative or summative evaluations (Rayanto, 2020: 38)

Instrument

How to conduct research instruments using test and non-test techniques. The test technique is a method used as a means of measuring knowledge, abilities, skills or characteristics of individuals or groups (Arikunto, 2020: 112). The test technique was carried out twice, namely at the beginning (pretest) and at the end of learning (posttest) with a total of 25 multiple choice questions. Pretest was conducted in order to find the initial ability of students before the application of Augmented Reality-based interactive media. Meanwhile, the final ability of students will be known after the posttest.

Before becoming a pretest and posttest question, researchers carry out validity and reliability tests on the question instruments to be used. Validity is the level of accuracy of an instrument in testing what is to be tested (Arikunto, 2020: 211). The validity test uses biserial point correlation formula. Reliability test is a test stage that is carried out to test the level of item confidence in making valid reliable measurements (Kurniawan & Puspaningtyas, 2016: 97). The validity test was carried out using the Cronbach's Alpha formula.

Non-test techniques are data collection methods that do not involve giving questions or tests to respondents. Researchers used 3 types of non-test techniques including observation, interviews, and questionnaires. Observation means an effort to collect data by observing the behavior and activities of individuals or groups at the research site (Creswell, 2018). An interview is a dialog conducted in order to obtain information and ideas (Sugiyono, 2017: 231). Researchers conducted observations at Pagendisan Elementary School in February 2024. Interviews were conducted with grade V teachers and the head of Pagendisan Elementary School. Questionnaire is an effort to collect data by distributing written questions to respondents to answer (Sugiyono: 2017: 142). Researchers used 3 types of questionnaires, including a needs questionnaire, a motivation questionnaire, and a response questionnaire. The needs questionnaire (Kustandi, 2020: 30-37) and the response questionnaire (Arsyad, 2020: 73-74) were given to grade V students and grade V teachers of SDN Pagendisan with a total of 15 questions using a Likert scale. The motivation questionnaire was given to fifth grade students of SDN Pagendisan with a total of 15 questions using a Likert scale. The learning motivation questionnaire indicators come from (Sudjana, 2021) with 8 indicators, namely interest, attention, needs, expectations, independence, perseverance, involvement, and satisfaction. The three types of questionnaires use a Likert scale with 4 options (Strongly Agree, Agree, Disagree, Disagree).

Data Analysis

Data analysis was carried out through 3 types of tests, namely feasibility testing, initial data analysis, and final data analysis. The feasibility test according to (Sugiyono, 2017: 190) is carried out to find out the products developed meet the established standards and are effective for use in the learning process. The feasibility test is carried out through an assessment from media experts, material experts, and users (students) to evaluate the quality of learning media seen from the aspects of content, presentation, language, and technical. Media assessment using a validation questionnaire contains 3 indicators, namely media tamplian, media presentation, and media benefits which are assessed with a rating scale (1 - 4). The material assessment includes 3 indicators, namely suitability to the curriculum, completeness of material, and clarity of material assisted by a rating scale (1 – 4).

Table 1. Interpretaion of the feasibility level of material validation

Percentage	Category
76% - 100%	Very feasible
51% - 75%	Worth
26% - 50%	Decent enough
0% - 25 %	Less feasible

Initial data analysis was carried out by carrying out a normality test on the pretest and posttest with the aim of measuring students' initial learning outcomes. The normality test was calculated using the Saphiro-Wilk formula. Final data analysis is the stage of data analysis used to find the impact of using AR-based learning media on student learning outcomes after intervention. Data was obtained from the posttest which was then calculated using the t-test and n-Gain tes.

Table 2. Interpretation of the n-Gain index

N-Gain Value	Criteria
N-Gain ≥ 0.70	High
0.30 < N-Gain < 0.70	Medium
N-Gain ≤ 0.30	Low

■ RESULT AND DISCUSSION

ADDIE is an approach that emphasizes an investigation of each component that has a relationsjip with each other with coordination in line with the existing phases (Sezer dkk., 2013: 137). The ADDIE model effectively supports users to create instructional content in diverse educational settings (Sial et al., 2024).

Analysis

Researchers identified needs through observation, interviews with fifth grade teachers, and distributing needs questionnaires. The needs questionnaire was given to fifth grade students and teachers of SDN Pagendisan. Completion of the questionnaire was carried out on December 21, 2024 by teachers and fifth grade students totaling 28 students. The results of the analysis of the student needs questionnaire were calculated by averaging the scores per question to obtain the following results. The average is calculated by adding the total score divided by the total questions multiplied by the number of respondents.

The results of student needs analysis show that most students agree to use technology-based learning media (Augmented Reality) to hel optimize motivation and learning outcomes and make the learning environment more interactive. Students habe curiousity because the have never used AR-based learning media. Students' sense of interest will bring up learning motivation which is in line with research (Afnan et al., 2021) which proves Augmented Reality learning media plays an effective role in increasing motivation, engagement, and understanding ef elementary school students through interactive and immersive learning experiences.

The results of the teacher needs analysis obtained the results of the interpretation of agreeing to the AR-based interactive media designed by researchers to be used in learning to optimize student motivation and learning outcomes. Along with research from (Ziden et al., 2022) which shows that the implementation of AR in the educational environment can optimize student motivation and learning outcomes

Table 3. Results of students needs questionnaire

No. of questions	SS (4)	S (3)	KS (2)	TS (1)	Total score	Mean score	Interpretation
Total	199	163	42	16	1385	3.2	Agree

Table 4. Results of the teacher needs questionnaire

No.	SS (4)	S (3)	KS (2)	TS (1)	Total	Mean	Interpretation
1-15	4	10	1	0	48	80	Agree

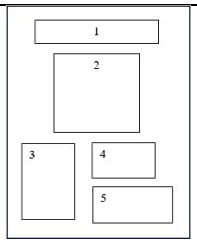
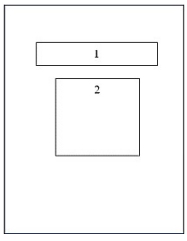
because it creates more dynamic and interactive learning.

Based on this analysis, researchers decided to develop AR-based flashcards that are able to show 3D objects about Indonesian Cultural Diversity, such as traditional houses, traditional clothes, and typical food accompanied by folk songs.

Design

The design or design stage is carried out by making Augmented Reality-based flashcard prototypes. Flashcard designs made amounted to 38, according to the current number of Indonesian provinces. The beginning of making flashcards using the help of the Canva application with various components such as the table below.

Table 5. AR-based flashcard prototype

No.	Prototype Components	Page Design	Description
1.	Front cover		1. Name of 2. house 3. Traditional clothes 4. Food 5. Information (capital city, name of traditional house, name of traditional clothes, name of typical food, folk song)
2.	Back cover		1. Name of 2. QR code contains *AR* elements and folk songs

Development

Product development is carried out after realizing the prototype design. The development was carried out with the help of the Assemblr Edu application to add 3D Augmented Reality objects about Cultural diversity such as traditional houses, traditional clothing, and folk songs. The integration of Augmented Reality in learning will make it easier for students to understand abstract subjects (Akçayýr & Akçayýr, 2017). The

implementation of Augmented Reality in basic education is able to increase student enjoyment, engagement, and learning outcomes (Basumatary & Maity, 2023). Here are the results of the development of Augmented Reality-based flashcard products.

Figure 2. Flashcard front side

Figure 2. Flashcard backside

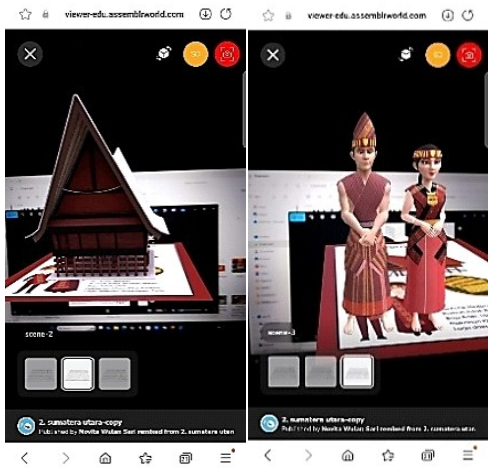


Figure 4. 3D view objects in flashcard

Flashcard media is considered effective in developing information literacy skills in students and is included as a fun learning media because it has various colors and pictures (Harisanty et al., 2020). Each flashcars made has different colors and images according to the diversity of each province in Indonesia.

The feasibility of flashcards will be tested through formative sheets from material experts and media experts. The feasibility test is carried out to find whether the media developed is feasible to be implemented in learning Pancasila education material on Indonesian cultural diversity in elementary schools. The results of material and media validation obtained the same score with a percentage of 89.5% categorized as "very feasible".

Implementation

Implementation is the application of the design and development that has been done. The implementation of AR-based interactive media was carried out on January 30, 2025 in class V SDN Pagendisan with 28 students. The results after implementing learning using flashcard media indicate that there is a significant increase in student learning outcomes.

Student learning outcomes have increased significantly. The pretest average acquisition was 59.71 increased in the acquisition of the posttest average to 88.85. The increase indicates that students understand well the material presented through the application of Augmented Reality-based flashcard media. Research by (Wang et al., 2023) AR offers interaction with digital content that makes learning more dynamic and interesting.

The acquisition of student learning outcomes is inseparable from learning motivation. Learning experience and motivation are the main factors for learning outcomes (Lo et al., 2022). The results of the research on student learning motivation obtained an average percentage of a high category based on the recapitulation of the questionnaire

Table 6. Material expert and media expert validation results

Aspects	Appraiser	Maximum Score	Score Achieved	Percentage	Category of Eligibility
Material validation	Material expert	48	43	89.5%	Very feasible
Media validation	Media expert	48	43	89.5%	Very feasible

Table 7. Recapitulation of students' pretest and posttest results

Acquisition of 28 students	Pretest	Posttest
Highest score	96	100
Lowest score	36	76
Average value	59.71	88.85
Number of students who completed	3	28

Table 8. Recapitulation of student motivation questionnaire

No.	Motivation indicators	Average percentage	Interpretation
1.	Students show interest in the material presented	100%	High
2.	Students are focused and serious when using AR-based flashcard media	87%	High
3.	Students feel helped by the use of AR-based flashcard media	91%	High
4.	Students hope to achieve better learning outcomes	87%	High
5.	Students are able to independently use the media	90%	High
6.	Students' efforts to understand the material through media	88%	High
7.	Students actively participate in learning	97%	High
8.	Student satisfaction with the learning outcomes obtained	92%	High

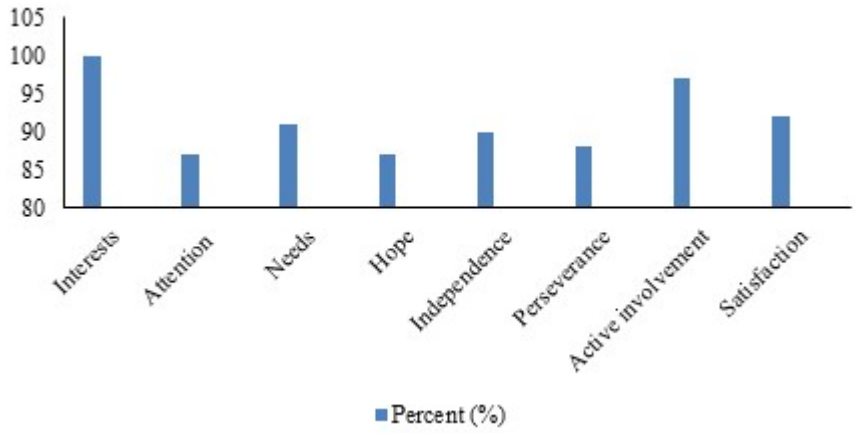


Figure 5. Results of recapitulation of student motivation questionnaire

that had been given. The motivation questionnaire contains 15 questions with a Likert scale of 4 preferences (strongly agree, agree, disagree, and disagree). The average answer to the questionnaire is strongly agree, so the application of AR-based flashcard media can be said to be successful in increasing student learning motivation.

The acquisition of student learning outcomes through pretest and posttest was tested for normality to assess whether the pretest and posttest results were normally distributed or not. The criteria for normally distributed data is the level of significance (p-values) past 0.05 ($p>0.05$). This research uses the Saphiro-Wilk method to calculate normality. Based on the Saphiro-Wilk statistical test, the pretest and posttest data have a p-value <0.05 which indicates that the data is normally distributed.

Table 9. Normality test

	Kolmogorov-Smirnov			Saphiro-Wilk		
	Statistic	**Df**	**Sig.**	**Statistic**	**Df**	**Sig.**
Pancasila 1 (pre)	.105	28	.200	.946	28	.157
Pancasila 2 (post)	.169	28	.038	.934	28	.080

The next statistical test is the t-test in order to find significant inequality between pretest and posttest scores. Data is said to be significant if the acquisition of a significance value (p-value) is not more than 0.05 ($p<0.05$). The t-test results obtained a p-value of 0.000, in other words, there is a significant inequality between the pretest and posttest results. This proves that the application of AR media in Pancasila education learning material on Indonesian cultural diversity is effective in optimizing student learning outcomes.

Tabel 10. Paired sample statistics

		Mean	**N**	**Std. Deviation**	**Std. Error Mean**
Pair 1	Pretest	59.71	28	13.939	2.634
	Posttest	88.86	28	7.168	1.355

Table 11. Correlation of paired samples

		N	**Corellation**	**Sig.**
Pair 1	Pretest & Posttest	28	.827	.000

Table 12. Paired sample test

		Paired differences							
					95% confidence interval of the difference				
		Mean	**Std. Deviation**	**Std. Error Mean**	**Lowee**	**Upper**	**t**	**df**	**Sig. (2-tailed)**
Pair 1	Pretest & Posttest	-29.143	8.969	1.695	-32.620	-25.665	-17.196	27	.000

The level of significance in learning outcomes was calculated with the n-Gain test. Data can be significant if it obtains an interpretation of more than equal to 0.70 (n-Gain d" 0.70). The results of the n-Gain analysis of this research scored 0.75 which is included in the high category. The score indicates that there is a sharp increase in student learning outcomes.

Table 13. n-Gain results

Category	Value
Pretest	59.71
Posttest	88.85
Average difference	29.14
Class n-Gain	0.75
Criteria	High
n-Gain score	75%

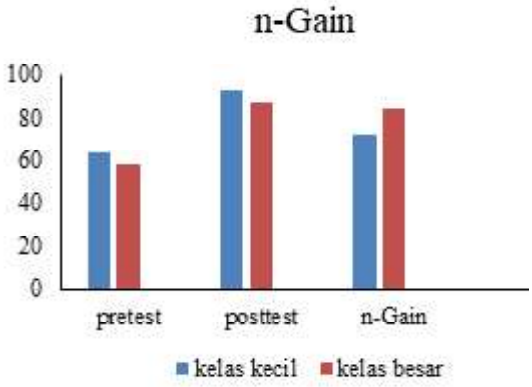


Figure 6. Results of n-Gain test

Evaluation

Evaluation is conducted to measure the effectiveness and feasibility of the developed learning media. The effectiveness and feasibility of the media are measured based on the data that has been collected. The results of data collection indicate that AR- based flashcard learning media are effective and feasible to use in learning Pancasila education on the material of Indonesian Cultural Diversity. This is evident from the acquisition of student learning outcomes that have increased significantly and increased student learning motivation when using AR-base flashcars media. Research by (Garzón et al., 2019) shows that AR is able to increase student engagement, enthusiasm, and academic performance by providing a fun learning experience.

The obstacle that researchers feel during research is that there are still some provinces that cannot be loaded with 3D Augmented Reality objects. This is because the province is still new so that the sources of information obtained are still limited. These obstacles can be overcome by researchers by conveying the actual information openly to students. Technology integration in education definitely has its own challenges (Hwang et al., 2022).

■ CONCLUSION

Learning media developed in the form of Augmented Reality-based flashcards are declared very feasible to be applied in learning Pancasila education material on Indonesian cultural diversity. Through this flashcard, students can be helped in understanding the material and knowing the real form of Indonesian cultural diversity through 3D Augmented Reality objects. The feasible statement is proven by the assessment of expert validators with a very feasible category. Teachers and students showed a positive response to the application of learning media developed.

This research is considered effective in creating interactive learning media based on Augmented Reality (AR) with the aim of optimizing student motivation and learning outcomes in Pancasila education on the material of Indonesian Cultural Diversity. Significant differences are evident in the acquisition of increased student learning outcomes. The integration of AR in learning Indonesian cultural diversity material helps optimize student learning motivation. This is reflected in the enthusiasm and active participation of students during learning, as well as evidence from distributing motivation questionnaires to students. This study highlights the potential for the use of AR to be expanded beyond Pancasila education subjects, further

increasing the effectiveness of digital learning media in basic education.

Suggestions for future research are to investigate the long-term effects of Augmented Reality on students' ability to retain knowledge and adapt to various disciplines. In addition, it could investigate the feasibility of AR integration on a larger scale, including accessibility and implementation challenges. This will provide greater insight for educational practitioners.

REFERENCES

Afnan, Muhammad, K., Khan, N., Lee, M. Y., Imran, A. S., & Sajjad, M. (2021). School of the future: A comprehensive study on the effectiveness of augmented reality as a tool for primary school children's education. *Applied Sciences (Switzerland)*, *11*(11). https://doi.org/10.3390/app11115277

Akçayýr, M., & Akçayýr, G. (2017). Advantages and challenges associated with augmented reality for education: A systematic review of the literature. *Educational Research Review*, *20*, 1–11. https://doi.org/10.1016/j.edurev.2016.11.002

Arsyad, M. (2020). *Media Pembelajaran*. Jakarta: PT Raja Grafindo Persada.

Basumatary, D., & Maity, R. (2023). Effects of Augmented Reality in Primary Education: A Literature Review. *Human Behavior and Emerging Technologies*, *2023*. https://doi.org/10.1155/2023/4695759

Billinghurst, M., Clark, A., & Lee, G. (2014). A survey of augmented reality. *Foundations and Trends in Human-Computer Interaction*, *8*(2–3), 73–272. https://doi.org/10.1561/1100000049

Bistaman, I. N. M., Idrus, S. Z. S., & Rashid, S. A. (2018). The Use of Augmented Reality Technology for Primary School Education in Perlis, Malaysia. *Journal of Physics: Conference Series*, *1019*(1). https://doi.org/10.1088/1742-6596/1019/1/012064

Creswell, J. W., & Creswell, J. D. (2018). *Research Design: Qualitative, Quantitative, and Mixed Method Approaches*. Los Angeles: SAGE Publications.

Deng, W., Wang, L., & Deng, X. (2024). Exploring interactive learning environments based on augmented reality technology. *International Journal of Interactive Mobile Technologies* , *18*(12), 15–29. https://doi.org/10.3991/ijim.v18i12.49911

Garzón, J., Pavón, J., & Baldiris, S. (2019). Systematic review and meta-analysis of augmented reality in educational settings. *Virtual Reality*, *23*(4), 447–459. https://doi.org/10.1007/s10055-019-00379-9

Geroimenko, V. (2020). Springer Series on Cultural Computing Augmented Reality in Education. 7–16.

Harisanty, D., Srirahayu, D., Kusumaningtiyas, T., Anugrah, E., & Permata, I. (2020). The Utilization of Flashcards in Children Information Literacy Development. *Library Philosophy and Practice*, *2020*(November), 1–12.

Herwin, H., Prasojo, L. D., Saptono, B., & Dahalan, S. C. (2023). Analyzing the Impact of Augmented Reality on Student Motivation: A Time Series Study in Elementary Education. *Ingenierie Des Systemes d'Information*, *28*(5), 1197–1203. https://doi.org/10.18280/isi.280507

Hwang, G. J., & Chang, S. C. (2022). *Learning with AR: A systematic review and meta-analysis*. Interactive Learning Environments, 30(6), 1089-1110.

Kurniawan, A., & Puspaningtyas, D. (2016). *Uji reliabilitas adalah*. Dalam A. Kurniawan & D. Puspaningtyas (Eds.), *Metode penelitian* (hal. 97). Yogyakarta: Pustaka Pelajar.

Kustandi, C., & Darmawan, D. (2020). *Pengembangan Media Pembelajaran: Konsep & Aplikasi Pengembangan Media Pembelajaran bagi Pendidik di*

Sekolah dan Masyarakat. Jakarta: Kencana.

Lo, K. W. K., Ngai, G., Chan, S. C. F., & Kwan, K. P. (2022). How students' motivation and learning experience affect their service-learning outcomes: a structural equation modeling analysis. *Frontiers in Psychology*, *13*(April), 1–12. https://doi.org/10.3389/fpsyg.2022.825902

Nadhif, M. F. J. L. P. F. P. H. S. K., & Putri, M. N. G. A. (2023). *Peran pendidikan pancasila dalam membentuk karakter peserta didik di sekolah. Jurnal Kewarganegaraan*, *7*(2), 1983–1988.

Nainggolan, G. A., Hanifah, N., & Nugraha, R. G. (2024). Jurnal cakrawala pendas andoid-based applications on learning " cultural diversity in indonesia " elementary school. *10*(4), 1048–1063.

Radu, I. (n.d.). Augmented reality in education/ : a meta-review and cross-media analysis augmented reality as educational medium. 1–17.

Rayanto, Y. H. (2020). *Penelitian pengembangan model addie dan r2d2: teori & praktek*. Lembaga Academic & Research Institute.

Risal, Z., Hakim, R., & Abdullah, A. R. (2022). *Metode penelitian dan pengembangan research and development (R&D): konsep, teori-teori, dan desain penelitian*. PT Literasi Nusantara Abadi Group. ISBN: 978-623-495-434-0.

Rusmaini. (2014). *Ilmu Pendidikan*.

Sapulette, V. (2023). *Penggunaan media pembelajaran augmented reality (ar) dalam meningkatkan hasil belajar siswa. Journal on Teacher Education*, *5*, 208–213. http://journal.universitaspahlawan.ac.id/index.php/jote/article/view/17417

Sial, Z. A., Fatima, Z., & Fatima, S. Z. (2024). Addie model of instructional effectiveness: analyzing the impact on students learning. Journal of law social studies, *6*(1), 64–72.

Sudjana. (2021). *Teori belajar dan pembelajaran dalam pendidikan*. Bandung: Remaja Rosdakarya.

Sugiyono. (2015). *Metode penelitian kuantitatif, kualitatif, dan R&D*. Bandung: Alfabeta.

Sugiyono. (2017). *Metode penelitian pendidikan: Pendekatan kuantitatif, kualitatif, dan R&D* (hal. 8, 39, 40, 130, 190). Bandung: Alfabeta.

Syafril, M., & Zen, Z. (2019). *Dasar-dasar ilmu pendidikan*. Prenada Media.

Timotheou, S., Miliou, O., Dimitriadis, Y., Sobrino, S. V., Giannoutsou, N., Cachia, R., Monés, A. M., & Ioannou, A. (2023). Impacts of digital technologies on education and factors influencing schools' digital capacity and transformation: A literature review. In *Education and Information Technologies* (Vol. 28, Issue 6). Springer US. https://doi.org/10.1007/s10639-022-11431-8

Trenggono Hidayatullah, M., Asbari, M., Ibrahim, M. I., Hadidtia, A., & Faidz, H. (2023). *Urgensi aplikasi teknologi dalam pendidikan di Indonesia.* Journal of Information Systems and Management, *02*(06), 70–73. https://jisma.org/index.php/jisma/article/view/785/137

Wang, P., Su, L., & Hong, J. (2023). The role of augmented reality in collaborative learning: Benefits and challenges. *Journal of Interactive Learning Research, 34*(2), 287-304. https://doi.org/10.1080/17501229.2024.2333539

Yahya, H. (2020). *Evaluasi dan penilaian dalam pembelajaran*. Deepublish.

Ziden, A. A., Ziden, A. A. A., & Ifedayo, A. E. (2022). Effectiveness of augmented reality (ar) on students' achievement and motivation in learning science. *Eurasia Journal of Mathematics, Science and Technology Education*, *18*(4). https://doi.org/10.29333/ejmste/11923