THE EFFECT OF AUGMENTED REALITY ON FOURTH-GRADE SOCIAL STUDIES OUTCOMES AT SDN 2 KALIWULU

Ismayanti Aiswarda[1], Diana Setiana[2], Wahyu Triono[3]
[1,2,3]Fakultas Keguruan dan Ilmu Pendidikan, Universitas Muhammadiyah Cirebon, Indonesa
E-mail: aiswardaismayanti@gmail.com

Abstrac
The low learning outcomes of elementary school students in social studies (IPS) indicate the need for innovative learning media capable of enhancing student engagement and understanding, particularly on abstract topics such as cultural diversity. This study aimed to analyze the effect of Augmented Reality (AR) media, assisted by the Assemblr Edu and Sketchfab applications, on the IPS learning outcomes of fourth-grade students on the topic of Indonesia's cultural diversity. This research employed a quantitative approach with a One-Group Pretest-Posttest experimental design. The sample consisted of 31 fourth-grade students at SDN 2 Kaliwulu, determined through a total sampling technique. Data were collected using a ten-item multiple-choice achievement test proven valid (r count> r table = 0.388) and reliable (Cronbach's Alpha = 0.744), supported by observation sheets and documentation. Data were analyzed using the Shapiro–Wilk normality test, the paired sample t-test, and the N-Gain test with SPSS 25. The normality test produced significance values of 0.059 (pretest) and 0.135 (posttest), indicating normally distributed data. The mean score increased from 57.10 (pretest) to 70.00 (posttest). The paired-samples t-test produced a significance value (2-tailed) of 0.000 ($p < 0.05$), so H0 was rejected, and H1 was accepted. The N-Gain analysis showed a mean value of 0.3125, categorized as moderate. These findings indicate that AR media has a significant effect on improving students' IPS learning outcomes and can serve as an innovative, interactive alternative learning medium in elementary schools.
Keywords: *Augmented Reality, Educational Technology, Learning Outcomes, Cultural Diversity Learning, Elementary Social Studies.*

INTRODUCTION

Learning media plays an important role in facilitating meaningful communication between teachers and students and supporting the achievement of instructional objectives. However, its use in elementary classrooms is not always optimal and is often limited to conventional functions as supplementary learning aids (Daniyati et al., 2023). Appropriate instructional media can clarify information, increase students' interest, and create more interactive learning environments (Fadilah et al., 2023; Nurazizah, 2024; Ningsih, 2024). In particular, interactive media can encourage students to actively analyze, synthesize, and evaluate information, potentially resulting in better learning outcomes than conventional approaches (Karo-Karo & Rohani, 2018; Akyuna et al., 2025).

Augmented Reality (AR) represents a promising form of interactive learning media because it integrates digital visualizations, text, audio, animation, and three-dimensional objects with the real learning environment. Such characteristics can provide students with more concrete and immersive representations of learning content while increasing attention and engagement (Wijayati, 2024). AR is also considered relatively accessible and applicable across learning contexts, although its implementation may be constrained by viewing-angle sensitivity and device-memory requirements (Qorimah & Sutama, 2022). These affordances are particularly relevant to elementary Social Studies (IPS), where learning involves not only factual knowledge but also the development of social values, communication, problem-solving, tolerance, and social responsibility

(Muhlis et al., 2024; Nasution et al., 2023).

The topic of Indonesia's cultural diversity presents a particular pedagogical challenge because students are expected to understand cultural objects and practices from different regions. Visual and interactive representations may therefore help elementary learners connect abstract information with concrete learning experiences. This is consistent with the view that learning outcomes are influenced by students' motivation, attitudes, intelligence, and learning environment, including the availability of appropriate learning facilities and media (Siregar, 2024). Previous studies have reported positive effects of AR on elementary students' learning outcomes. Nafis and Fathurrahman (2024), for example, reported moderate to high N-Gain values, while Melani and Cunandar (2025) found a significant improvement in fifth-grade IPAS outcomes. Similarly, Pradita et al. (2024) reported improved conceptual understanding among fourth-grade students, and Balo et al. (2025) found that AR supported by Assemblr Edu significantly improved elementary students' learning outcomes.

Despite these findings, previous studies have predominantly examined AR in science or general elementary learning contexts, leaving limited empirical attention to its application in Social Studies learning on Indonesia's cultural diversity. Moreover, the pedagogical potential of combining three-dimensional AR representations with classroom learning activities using platforms such as Assemblr Edu and Sketchfab remains insufficiently examined in this context. This study therefore investigates the use of AR media supported by Assemblr Edu and Sketchfab in fourth-grade Social Studies learning on Indonesia's cultural diversity. Specifically, it examines changes in students' learning outcomes following AR-supported instruction and provides empirical evidence regarding the potential of interactive three-dimensional media to facilitate students' understanding of culturally diverse learning content.

METHOD

This study employed a quantitative approach using an experimental method in the form of a one-group pretest-posttest design. A sample class was administered a pretest, then received instruction using AR media, and subsequently took a posttest. This design was chosen to directly determine the differences in students' learning outcomes before and after the intervention. The study was conducted at SDN 2 Kaliwulu, Jl. Ki Natagama, Desa Kaliwulu, Kecamatan Plered, Kabupaten Cirebon, with fourth-grade students during the 2025–2026 school year, and took place on May 25–26, 2026. The population of this study consists of all students enrolled at SDN 2 Kaliwulu. The study sample comprised 31 fourth-grade students, selected using a nonprobability sampling technique known as total sampling, since all members of the fourth-grade population were included in the study sample. The independent variable in this study is the use of Augmented Reality (AR) media, which is operationally defined as digital technology-based learning media that integrates 3D objects, text, animations, and audio into the real environment in real time, displayed via mobile devices using the Assemblr Edu and Sketchfab applications. The dependent variable is student learning outcomes, measured by students' cognitive achievements in understanding and recalling material on cultural diversity.

Instruction was conducted using the Problem-Based Learning (PBL) model supported by AR media, with students guided to observe cultural objects displayed via AR and then identify information related to those objects, which were projected using a projector so that all students could observe the three-dimensional objects together. Data collection was conducted using three instruments, namely: (1) a learning outcome test consisting of 10 multiple-choice questions designed based on an

instrument outline at cognitive levels C2–C4, administered as a pretest before the intervention and a posttest after the intervention; (2) an observation sheet using a 4-point Likert scale to assess student engagement and the implementation of the learning process during the use of AR media; and (3) documentation in the form of photographs of learning activities, test sheets, teaching modules, and student learning achievement data.

Before use, the test instrument was validated using Pearson's product-moment correlation with the aid of IBM SPSS Statistics 25. With rtable = 0.388 ($\alpha = 0.05$; df = 24), all 10 test items yielded calculated r values ranging from 0.456 to 0.713 with significance levels below 0.05; thus, all test items were deemed valid. A reliability test using Cronbach's Alpha yielded a coefficient of 0.744 (> 0.70), indicating that the instrument is reliable and suitable for use as a data collection tool. Data analysis began with the Shapiro–Wilk normality test which is appropriate for sample sizes of fewer than 50 respondents to determine whether the pretest and posttest data were normally distributed. Next, hypothesis testing was conducted using a paired-sample t-test to determine whether there was a significant difference between the pretest and posttest scores within the same group of students, with the null hypothesis (H0) rejected if the p-value was less than 0.05. Finally, the N-Gain test was used to measure the extent of improvement in learning outcomes, which was interpreted based on Hake's (1998) criteria: $g > 0.70$ (high), $0.30 \leq g \leq 0.70$ (moderate), and $g \leq 0.30$ (low).

RESULT AND DISCUSSION

Based on the pretest administered to 31 fourth-grade students before the intervention, the highest score was 80, the lowest was 20, and the average was 57.10, indicating that the students' initial understanding of cultural diversity was still relatively low. After the intervention using AR media supported by Assemblr Edu and Sketchfab, the posttest results showed a highest score of 100, a lowest score of 40, and an average that increased to 70.00, indicating an improvement in student learning outcomes, as presented in Table 1.

Table 1. Result pretest and posttest students

Variable	N	Sig.	Interpretation
Pretest	31	.059	Normal
Posttest	31	.135	Normal

The results of observations conducted over two sessions showed that the implementation of learning using AR media went well and was in line with the learning objectives. In terms of knowledge, students were able to identify various forms of cultural diversity and relate the material to cultural conditions in their surrounding environment. In terms of attitude, students demonstrated an appreciation for cultural diversity and actively participated by asking and answering questions. In terms of skills, students were able to operate the AR media independently with minimal guidance from the teacher.

The Shapiro–Wilk normality test yielded a p-value of 0.059 for the pretest data and 0.135 for the posttest data; both values were greater than 0.05. Therefore, the pretest and posttest data were deemed to be normally distributed and suitable for parametric analysis using a paired-sample t-test, as shown in Table 2.

Table 2. Normality Test

Variable	N	Mean	Std. Deviation	Min	Max
Pretest	31	57.10	14.88	20	80
Posttest	31	70.00	14.26	40	100

The results of the paired-sample t-test showed a mean difference of −12.903 between the pretest and posttest scores, a correlation coefficient of 0.748 (p = 0.000), indicating a strong relationship between the two measurements, as well as a t-value of −6.914 with df = 30 and a significance level (two-tailed) of 0.000 ($p < 0.05$). Thus, H0 is rejected and H1 is accepted, meaning there is a significant difference between students' social studies learning outcomes before and after the use of AR media, as presented in Table 3.

Table 3. Paired Samples t-test

Variable	Mean	t	df	p-value
Pretest - Posttest	-12.903	-6.914	30	.000

The results of the N-Gain analysis showed a minimum value of −0.20, a maximum value of 1.00, a mean value of 0.3125, and a standard deviation of 0.24722. Based on Hake's (1998) criteria, this mean value falls into the moderate category ($0.30 \leq g \leq 0.70$), indicating that, on average, the use of AR media improves student learning outcomes to a moderate extent, although this improvement varies among students, as shown in Table 4.

Table 4. Statistic N-Gain

N	Min	Max	Mean	Std. Deviasi	Category
31	-0,20	1,00	0,3125	0,24722	Moderate

The use of augmented reality (AR) media supported by Assemblr Edu and Sketchfab provides a more concrete and interactive learning experience compared to the two-dimensional illustrations found in conventional textbooks. By observing 3D visualizations of traditional houses, traditional clothing, traditional musical instruments, and other cultural elements projected via a projector, students can engage more directly with the material, rather than simply listening to the teacher's explanations. The results of the observation show that students become more active, enthusiastic, and capable of operating the technology independently with minimal guidance, in line with the findings (Purwanto, Putra, dan Suhendro 2025) which states that AR media has a positive effect on the learning outcomes of elementary school students because it is able to present abstract concepts in an interactive and visual way.

The increase in learning outcomes from a pretest average of 57.10 to a posttest average of 70.00, along with a significant result from the paired-sample t-test ($p = 0.000$), indicates that AR media has a significant effect on students' understanding of cultural diversity. These findings are consistent with research Riyantono & Makmur (2024) which found that AR-based media is effective in increasing student participation, motivation, and enthusiasm during learning, as well as Rahmah et al., (2025) which reports that AR significantly improves learning outcomes because students can interact directly with learning objects, making the learning process more effective and meaningful.

Although the average increase was moderate (N-Gain = 0.3125), the fairly wide range between the minimum (−0.20) and maximum (1.00) values indicates that the effect of AR media was not uniform across all students. This variation is likely related to differences in students' prior abilities, levels of understanding, engagement during learning, and ability to utilize technology, which aligns with the perspective of internal factors in learning outcomes (Siregar 2024). Nevertheless, the overall pattern of findings supports the view that AR media is suitable for elementary school students, who generally are still in the concrete operational stage of cognitive development and therefore find it easier to understand material presented in a visual, concrete, and interactive manner.

In addition to cognitive benefits, the use of AR media also appears to strengthen students' social skills. Visualizations of cultural objects from various regions encourage students to consider different perspectives and social situations, thereby fostering the development of empathy, while discussion and question-and-answer activities during AR based learning promote interpersonal communication in a fun and innovative learning environment (Zulfa et al. 2025). Thus, Augmented Reality media supported by Assemblr Edu and Sketchfab can serve as an effective and innovative alternative learning tool to improve fourth-grade students' social studies learning outcomes on the topic of Indonesia's cultural diversity, while also enhancing students' engagement, motivation, and skills in the learning process.

CONCLUSION

The use of Augmented Reality (AR) media has been shown to have a positive impact on learning outcomes in science classes at the elementary school level. The use of AR media provides a more interactive and contextual learning experience, helping students understand the material more concretely, increasing their engagement in the learning process, and promoting improved learning outcomes. This study investigated the effect of Augmented Reality (AR) media on the learning outcomes of fourth-grade elementary students in learning cultural diversity. The findings revealed a statistically significant difference between students' pretest and posttest scores after the implementation of AR-based learning media. These results indicate that AR has the potential to support students' understanding of cultural diversity concepts by providing interactive and three-dimensional learning experiences.

The findings provide practical implications for elementary school teachers by demonstrating that AR can serve as an innovative instructional medium to enhance classroom engagement and facilitate students' conceptual understanding of cultural diversity. Nevertheless, this study has several limitations. It employed a one-group pretest–posttest design without a control group, which limits the ability to establish causal relationships. In addition, the study was conducted in a single elementary school with a relatively small sample size, thereby limiting the generalizability of the findings.

Future research is recommended to employ more rigorous experimental designs involving control groups, larger and more diverse samples, and longer intervention periods. Further studies may also investigate the effectiveness of different AR applications and explore their impact on other learning outcomes, such as critical thinking, learning motivation, and student engagement.

REFERENCES

Aisyah, Siti, Muhammad Sholeh, Indah Bunga Lestari, dan Lusi Dwi Yanti. 2024. "Peran Penggunaan Teknologi dalam Pembelajaran IPS di Era Digital." 4(April): 44–52.

Balo, Jovvinitra Miha, Taty R Koroh, dan Adam B N Benu. 2025. "Pengaruh Penggunaan Media Pembelajaran Augmented Reality (AR) Terhadap Hasil Belajar Siswa Tentang Kabupaten Kupang." *Pendas : Jurnal Ilmiah Pendidikan Dasar* 10(02): 304–12.

Daniyati, Ani, Ismy Bulqis Saputri, Ricken Wijaya, Siti Aqila Septiyani, dan Usep Setiawan. 2023. "Konsep Dasar Media Pembelajaran." 1(1): 282–94.

Dirgantara Wicaksono, Iswan. 2019. "Upaya meningkatkan hasil belajar peserta didik melalui penerapan model pembelajaran berbasis masalah di kelas iv sekolah dasar muhammadiyah 12 pamulang, banten." *HOLISTIKA : Jurnal Ilmiah PGSD* 3(2579 – 6151): 111–26.

Esti Nur Qorimah, Sutama. 2022. "Studi Literatur: Media Augmented Reality (AR) Terhadap Hasil Belajar Kognitif." *Jurnal Basicedu* 6(2): 2055–60.

Fadila Djou, Abdurahman R Mala, Anugrah Lestari. 2025. "Peningkatan Meningkatkan Hasil Belajar Peserta Didik Melalui Pembelajaran Berdiferensiasi di Kelas IV SD Negeri 8 Limboto Barat Kab. Gorontalo." *Jurnal Manajemen dan Pendidikan Agama Islam* 3(E-ISSN : 3031-8394): 166–75.

Fadilah, Aisyah, dan Nasywa Atha Kanya. 2023. "Pengertian Media , Tujuan , Fungsi , Manfaat dan Urgensi Media Pembelajaran." 1(2).

Harahap Heri Hari Yanti, Samakmur, Nurbaiti. 2023. "Peningkatan Hasil Belajar Siswa Dengan Menggunakan Model Pembelajaran Think Pair Share (Tps) Pada Materi Tema 1 Sub Tema 3 Di Kelas Iii SD Negeri 101350

Purbatua." *Jurnal Imiah Pendidikan Dasar (JIPDAS)* 3(2): 446–59.

Isran Rasyid Karo-Karo S, Rohani. 2018. "Manfaat Media Dalam Pembelajaran." Vol. VII,(P-ISSN : 2087 – 8249): 91–96.

M. Muhlis, Sholahuddin Al Ayyubi, Khairil Candra Wijaya, Istiningsih. 2024. "Orientasi Pembelajaran Ips Pada Pendidikan Sekolah Dasar: Membangun Keterampilan Bersosial Siswa." *Pendas : Jurnal Ilmiah Pendidikan Dasar* 09.

Muliadi, Sudirman, Irmayanti. 2025. "Peningkatan Hasil Belajar IPAS Melalui Penerapan Model Pembelajaran RADEC Siswa Kelas V SD." *Jurnal Pendidikan &mPembelajaran Sekolah Dasar* 5(2): 226–34.

Nanda Lailatul Nafis, Moh. Fathurrahman. 2024. "Development of digital learning media based on augmented reality to improve student learning outcomes of elementary school." *Research and Development in Education (RaDEn)* 4(22).

Nasution, Fadhilah Hilmy, Irlyanova Sabina, Putri Puspitasari, M Falih, Fakultas Ilmu, Tarbiyah Dan, Keguruan Universitas, Islam Negeri, dan Sumatera Utara. 2023. "Penerapan Pembelajaran IPS Pada Tingkat MI / SD." *Jurnal Pendidikan Tambusai* 7: 32140–51.

Nia Melani, Dadang Cunandar. 2025. "Pengaruh Penggunaan Media Pembelajaran Augmented Reality Terhadap Hasil Belajar Ipas Siswa Kelas V Sdn Karanganyar." *Jurnal Pemikiran dan Penelitian Pendidikan Dasar* 9(ISSN 2614-1051): 33–43.

Ningsih, Farikha Septia. 2024. "Implementasi Media Pembelajaran Interaktif dalam Menunjang Pemahaman Siswa MI di Era Society 5 . 0." *Jurnal Al – Mau'izhoh* 6(1): 683–98.

Nurazizah, Siti. 2024. "Pentingnya Media dalam Pembelajaran untuk Meningkatkan Hasil Belajar Siswa." 3: 5666–70.

Pradita, Adnia Rianti, Ani Nur Aeni, dan Atep Sujana. 2024. "Pengaruh Media Augmented Reality Untuk Meningkatkan Pemahaman Konsep Siswa Kelas IV SDN Tegalkalong pada Materi Fotosintesis." *INKUIRI: Jurnal Pendidikan IPA* 13(1): 1–8. doi:10.20961/inkuiri.v13i1.83995.

Purwanto, Vivi Devriana, Adi Putra, dan Petrus Suhendro. 2025. "Penggunaan Media Augmented Reality Sebagai Upaya Dalam Meningkatkan Hasil Belajar Siswa Sekolah Dasar." *Pendas : Jurnal Ilmiah Pendidikan Dasar* 10.

Rahmah, Maula, Linda Vitoria, dan Mislinawati. 2025. "Jurnal basicedu." *Jurnal Basicedu* 9(2): 436–46.

Reyza Qurrota Akyuna, Ana Dwi Wahyuni, Diyah Mintasih. 2025. "Peran Media Pembelajaran Interaktif Dalam Meningkatkan Partisipasi Peserta Didik." *jurnal Hukum, Pendidikan & Sosial Keagamaan* 5: 121–32.

Riyantono, Noberta Nissa Edina, dan Amelia Makmur. 2024. "Efektivitas Penggunaan Media Pembelajaran Berbasis Augmented Reality Di Sekolah Dasar." *Pendas : Jurnal Ilmiah Pendidikan Dasar* 09: 298–308.

Siregar, Halimah Tusaddiyah. 2024. "Faktor-Faktor yang Mempengaruhi Hasil Belajar Dalam Pembelajaran PAI." *Jurnal Ilmu Tarbiyah dan Keguruan (JITK)* 2(2): 215–26.

Zulfa, Atikah, Muhammad Muchsin Afriyadi, Baharudin, dan Ida Fiteriani. 2025. "Pengaruh Media Augmented Reality Terhadap Minat Belajar dan Pemahaman Konsep dalam Pembelajaran IPAS." *Edukasiana: Jurnal Inovasi Pendidikan* 4(3): 1040–50.