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The Effect of Assemblr Edu Based Augmented Reality Media On Students Conceptual Understanding of the Water Cycle

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ABSTRACT

This study aims to determine the effect of augmented reality based on Assemblr Edu on student's conceptual understanding of the water cycle topic. This research employed a quantitative approach using a quasi experimental method with a nonequivalent control group design involving two groups. The sample of this study consisted of fifth-grade elementary school students from two different elementary schools that are located in Situraja District. Student's conceptual understanding of the water cycle topic showed improvement, as indicated by the results of the Independent Sample t-test, which obtained a significance value (2-tailed) 0,000. This result indicates that there is a significant difference in the posttest mean score as the value is less than 0,05. In addition, an N-Gain test was conducted to determine the improvement in student's conceptual understanding. This results showed that the average posttest score of the control group was 42,52 while the experimental group obtained a higher average posttest score of 64,34. The results of the analysis indicated a significant difference in conceptual understanding between the experimental group and the control group.

ABSTRAK

Penelitian ini bertujuan untuk mengetahui pengaruh media AR berbasis Assemblr Edu terhadap pemahaman konsep siswa pada materi siklus air. Penelitian ini menggunakan pendekatan kuantitatif dengan desain quasi experimental design tipe nonequivalent control group design yang melibatkan dua kelompok. Sampel dalam penelitian ini adalah siswa kelas V SD di dua sekolah dasar yang berada di Kecamatan Situraja. Pemahaman konsep siswa pada materi siklus air mengalami peningkatan, ditunjukkan dengan hasil uji Independent Sample t-test yang memperoleh nilai signifikansi (2-tailed) 0,000 yang menunjukkan bahwa terdapat perbedaan rata-rata posttest karena kurang dari 0,05. Selain itu, dilakukan uji N-Gain untuk mengetahui peningkatan pemahaman konsep siswa, uji ini memperoleh nilai rata-rata posttest kelompok kontrol sebesar 42,52 dan rata-rata posttest kelompok eksperimen sebesar 64,34. Hasil analisis menunjukkan adanya perbedaan pemahaman konsep antara kelompok eksperimen dan kelompok kontrol.

INTRODUCTION

Elementary schools implement the *Merdeka Curriculum*, which integrates subjects into *IPAS* Science and Social Studies (Safitri et al., 2024). Science and Social Studies are interrelated; for example, when a natural disaster occurs, its impacts extend beyond the environment and affect the community's social life. This is reinforced by the opinion of Ummah and Mustika (2024), who stated that IPAS learning in elementary schools is related to students' surrounding environment, thereby stimulating their curiosity. IPAS learning aims to develop students' concern for nature and society and enhance their knowledge and skills (Wigalina et al., 2024). A distinctive characteristic of IPAS is that it encompasses knowledge about nature and human social life, incorporating values, attitudes, and processes such as observation, classification, temporal relationships, and measurement, as Sulthon (as cited in I Nyoman Sudirman & I Kadek Purnayasa, 2024) states. Elementary school students engage in various experiments and observations to solve issues related to nature and life through IPAS learning (Takndare et al., 2026).

Learning theories examine how individuals form knowledge and aim to develop the character and knowledge needed through various forms of information (Fithriyah et al., 2024). Several learning theories are commonly applied, including constructivist learning theory. This theory views learning as a process of introducing new ideas or theories, encouraging students to understand concepts and apply them in daily life (Fithriyah et al., 2024). Constructivist theory requires teachers to position themselves to help students explore knowledge independently through learning experiences or interactions with problems (Azzahra, 2025). This theory views learning not merely as the transfer of information from teachers to students, but as students' active participation in seeking and constructing their own knowledge (Azzahra, 2025). Constructivism views learning as a process of assigning meaning to individuals' experiences (Azzahra, 2025). Based on constructivist theory, students build their own knowledge from their prior experiences.

Conceptual understanding refers to students' ability to process words when providing explanations and to draw conclusions from information presented in various forms (Novanto et al., 2021). Conceptual understanding can determine the success of the teaching and learning process (Purwanti et al., 2024). Conceptual understanding develops students' skills in explaining concepts and drawing conclusions from information presented as numbers, text, and images (Apriansah et al., 2024). According to Anderson and Krathwohl (Novanto et al., 2021), conceptual understanding has seven indicators: explaining, interpreting images or tables, exemplifying, classifying based on certain characteristics, summarizing, inferring, and comparing. These seven aspects involve different cognitive levels, ranging from C2 to C4 according to Bloom's Taxonomy. According to Artadana, I Kt., Raga, Gd., and Pudjawan (as cited in Susilawati et al., 2024), three factors contribute to students' lack of conceptual understanding in science learning. First, teacher-centered learning results in low student participation. Second, insufficient physical activity may cause students to feel bored and sleepy. Third, efforts should be made to present real phenomena so that the learning material becomes more relevant and easier for students to understand.

Learning media are tools teachers use to deliver learning materials through images, written texts, or audio (Fadila, 2023). Learning media present information in detail through engaging visual representations (Elsa Kaniawati et al., 2023). Conceptual understanding among elementary school students requires visual support because they are at the concrete operational stage (Nur et al., 2026). According to Syamsiani (2022), learning media facilitates the learning process while prioritizing the achievement of learning objectives, making learning more efficient and stimulating students' curiosity

and participation. Students' learning experiences can be developed through the assistance of learning media (Faizah & Mawardi, 2026). In the topic of the water cycle, students' abilities are not only directed toward recognizing the stages of the water cycle but also toward developing a systematic conceptual understanding. Visual media are needed to present each stage of the water cycle clearly. Elementary school students are at the concrete operational stage; therefore, their thinking remains relatively simple and requires visual support to understand a theory (Ilham et al., 2024).

Learning media that integrate technology or digital learning media are needed to introduce instructional innovations that create enjoyable yet meaningful learning experiences. In addition, learning innovations can help evaluate the learning process and determine which media are expected to improve students' conceptual understanding. Digital media create an enjoyable learning experience for students through animations, colorful displays, and bright visual elements (Nurhamidah et al., 2022). Children's lack of motivation in learning is caused by boredom resulting from learning activities that focus on memorization and the assignment of tasks (Janah et al., 2023). According to Kristiana and Radia (2021), in elementary school science learning, teachers tend to emphasize mastery of the subject matter without considering the learning experiences that students should obtain. Consequently, students' learning activities become passive because learning is teacher-centered and relies on brief explanations supported by textbook-based media (Shofiyah et al., 2024). Students' conceptual understanding of abstract IPAS materials remains low, particularly in the indicators of comparing and summarizing. This is consistent with the following students' pretest data obtained before the learning process was conducted.

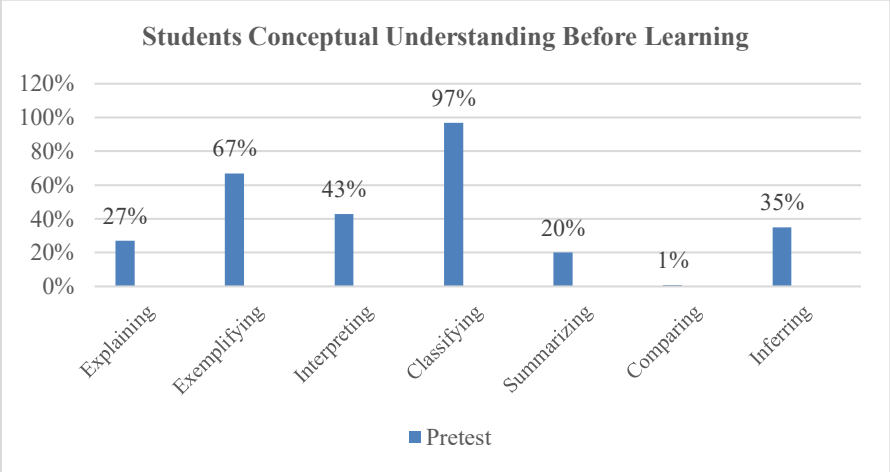


Figure 1. Students Conceptual Understanding Before Learning

With support from representative learning media, students' learning experiences can be further developed, and their motivation to learn can increase. According to Kristiana and Radia (2021), science learning in elementary schools tends to emphasize subject-matter mastery without considering the learning experiences students should gain.

Student-centered learning supported by textbook-based media results in less optimal student engagement in the learning process (Shofiyah et al., 2024). To address these problems, *augmented reality* can provide a realistic representation of the water cycle at each stage. *Augmented reality* visualizes objects that cannot be directly observed, making them clear and supporting learning by improving students' understanding of

abstract science concepts (Purwanti et al., 2024). AR media provide realistic visualizations that make students feel as though they are directly observing the objects (Qorimah & Sutama, 2022). Elementary school students are at the concrete operational stage; therefore, their thinking remains relatively simple and requires visual support to understand a theory (Ilham et al., 2024).

Referring to the problems described above, the research question is formulated as follows: "What is the effect of *Assemblr Edu*-based AR on students' conceptual understanding of the water cycle?" Today's education requires digitalization, including innovative media that bridge abstract concepts and natural processes students cannot observe directly. In addition, conceptual understanding in IPAS learning is a fundamental competency for students to understand their environment; therefore, learning media are needed to overcome the limitations of direct observation. AR is an innovative learning medium that provides 3D visualization through interaction between the virtual and real worlds, characterized by interactivity, real-time visualization, and three-dimensional objects (Yusup et al., 2023). AR media provide students with realistic visualizations, allowing them to feel as though they are directly observing the objects (Qorimah & Sutama, 2022). The advantages of *Augmented Reality* include the following (Rinaldi et al., 2024):

1. Provides an engaging learning experience.
2. Facilitates interactive learning.
3. Supports hybrid learning because it can be accessed through the internet.
4. Displays 3D images in real time
5. Stimulates students' curiosity and interest in learning.

Table 1. Research Gap

Study	Media	Material	Variable	Research Gap
(Carolina, 2022)	AR	Earth as a Planet	Learning Motivation	The study did not use *Assemblr Edu* because the study developed its own AR media using Unity Hub and Unity Editor.
(Firdausa & Darmawan, 2024)	AR	Harmony in Ecosystems	Learning Motivation	The study did not use *Assemblr Edu* and has not examined conceptual understanding.
(Purwanti et al., 2024)	AR	Science Material, but not specifically explained	Conceptual Understanding	The study used a literature review method; therefore, it did not examine the indicators of conceptual understanding measured in the study.
(Anggriyani, 2024)	AR	Science Material, but not explained in detail	Conceptual Understanding	The study focused on the development of AR media using the Research and Development (R&D) method.
This study	AR based on *Assemblr Edu*	Water cycle	Conceptual Understanding	Addresses the research gaps identified in previous studies.

METHOD

A quantitative approach was applied because the data were described numerically. Quantitative research involves calculating and measuring means, percentages, and other statistical calculations (Prayogi et al., 2024). According to Sugiyono (as cited in Nasution & Junaidi, 2024), a research method is a means of obtaining data for a specific purpose. Research methods aim to ensure that the research is conducted systematically and achieves optimal results. According to Dartiningsih (2016), a research method is a technical tool for collecting research data and therefore explains the steps involved in obtaining data. The experimental method was employed because, in education, experiments aim to examine how a treatment affects students' learning outcomes. Experiments in education generally examine the effects of methods, models, materials, or media as innovations to optimize the teaching and learning process (Farhan Arib et al., 2024). A *quasi-experimental, nonequivalent control group design* was employed because it required two sample groups. There are three characteristics of quasi-experimental research: (1) there is a group that receives treatment, (2) the sample is not randomly selected, and (3) the groups are manipulated (Farhan Arib et al., 2024).

This study included 30 fifth-grade students from two elementary schools in Situraja District. The study was conducted in the second semester of 2026 in fifth-grade classes on the topic of the water cycle. The first study was conducted in the experimental class for four days, from 27 April 2026 to 30 April 2026. The second study was conducted in the control class for four days, from 4 May 2026 to 7 May 2026. This study used test data consisting of twelve conceptual understanding items. Before the items were administered, they underwent a series of validity and reliability tests to meet the standards and requirements for instrument feasibility through a series of trials and analyses using SPSS version 16.

Table 2. Validity Correlation Interpretation

Correlation Coefficient	Correlation	Validity Interpretation
0,80 – 1,00	Very High	Very Good
0,60 – 0,80	High	Good
0,40 – 0,60	Moderate	Moderate
0,20 – 0,40	Low	Poor
0,00 – 0,20	Very Low	Very Poor

Based on the results of the instrument trial involving 29 students who were not included in the research sample and 12 essay questions, the results are presented as follows:

Table 3. Validity Test

Item No	rhitung	rtabel	Validity	Correlation	Decision
1.	0,287	0,367	Invalid	Low	Revise
2.	0,472	0,367	Valid	Moderate	Used
3.	0,728	0,367	Valid	High	Used
4.	-0,171	0,367	Invalid	Very Low	Revise
5.	0,729	0,367	Valid	High	Used
6.	0,625	0,367	Valid	High	Used
7.	0,599	0,367	Valid	Moderate	Used
8.	0,741	0,367	Valid	High	Used
9.	0,511	0,367	Valid	Moderate	Used

Item No	rhitung	rtabel	Validity	Correlation	Decision
10.	0,576	0,367	Valid	Moderate	Used
11.	0,509	0,367	Valid	Moderate	Used
12.	0,634	0,367	Valid	High	Used

Based on the table, 10 items were found to be valid, while 2 items were found to be invalid. The invalid items were revised based on the guidance and feedback provided by experts in the field of science education to ensure that they were appropriate for use.

Table 4. Interpretation of Reliability Coefficient Classification

Reliability Coefficient	Interpretation
0,80 – 1,00	Very High
0,60 – 0,79	High
0,40 – 0,59	Moderate
0,20 – 0,39	Low
0,00 – 0,19	Very Low

Based on the results of the trial involving 29 students who were not included in the research sample and 12 essay items, the results of the reliability test are presented as follows:

Table 5. Interpretation of Reliability Coefficient Classification

Cronbach's Alpha	N of Items
.714	12

Based on the reliability test results, the reliability coefficient for the 12 essay items was 0.714, indicating high reliability for the concept understanding test, as the coefficient exceeded 0.60.

The normality test was conducted as a prerequisite using the *Shapiro–Wilk* test because the sample consisted of 30 students. Subsequently, *Levene's test* was used to assess whether the research samples had homogeneous variances. These tests were conducted as prerequisites for testing the hypothesis about differences in mean scores using the *independent-samples t-test*. Furthermore, the N-Gain test was conducted to measure the improvement in students' conceptual understanding following the treatment and to determine the magnitude of the improvement.

Table 6. Research Design

Group	*Pretest*	Treatment	*Posttest*
Experimental	O1	X	O2
Control	O3	-	O4

Sugiyono (as cited in Khaira et al., 2025)

Notes:
O1 : *Pretest* of the experimental group
O2 : *Posttest* of the experimental group
O3 : *Pretest of the control group*
O4 : *Posttest of the control group*
X : *Treatment provided in the form of learning using augmented reality media based on Assemblr Edu*

RESULTS AND DISCUSSION

Results

The research was conducted over four days in two elementary schools. On the first day, the students were administered a *pretest* to assess their initial knowledge. On the second and third days, the learning activities were conducted. The experimental group received treatment using *augmented reality* media based on *Assemblr Edu*. On the fourth day, the students were administered a *posttest* to measure the improvement in their conceptual understanding. The students' *pretest* and *posttest* data are presented below:

Table 7. *Pretest* and *Posttest data*

No	Control		Experimental	
	Pretest	***Posttest***	***Pretest***	***Posttest***
1.	37	43	63	97
2.	43	80	23	70
3.	50	57	60	100
4.	13	43	50	77
5.	20	60	40	70
6.	27	57	13	57
7.	27	43	60	90
8.	27	60	50	80
9.	53	77	50	93
10.	33	50	57	80
11.	20	47	47	70
12.	23	33	47	93
13.	40	60	43	70
14.	40	60	33	90
15.	23	60	50	87
16.	17	63	57	87
17.	33	63	20	63
18.	40	73	40	80
19.	33	53	63	93
20.	33	70	43	70
21.	23	57	30	87
22.	23	53	33	63
23.	40	67	33	57
24.	37	63	57	70
25.	53	97	33	60
26.	30	70	30	77
27.	40	83	33	100
28.	43	63	20	73
29.	43	80	17	77
30.	43	57	40	73
Mean				
	33.57	61.40	41.17	78.47

Based on the table, both the control and experimental groups consisted of 30 students, and all students demonstrated an improvement in conceptual understanding, as indicated by their higher posttest scores compared with their pretest scores.

Table 8. Normality Test

	Statistic	**df**	**Sig.**
Pre-Kon	.966	30	.429
Post-Kon	.973	30	.614
Pre-Eks	.956	30	.248
Post- Eks	.955	30	.229

Based on the table, the *Shapiro–Wilk* normality test yielded significance values of 0.427 for the control group's *pretest* and 0.614 for the *posttest*. Meanwhile, the significance values for the experimental group's *pretest* and *posttest* were 0.248 and 0.229, respectively. Based on these results, the research data were normally distributed, as all *pretest* and *posttest* significance values were greater than 0.05.

Table 9. Homogenity Test

	Levene Statistic	**Sig.**
Based on Mean	3.298	.075

Based on the table, the significance value was 0.075, indicating that the two sample groups had homogeneous variances, as 0.075 > 0.05.

Table 10. *Paired Sample t-test*

	Paired Differences					Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		
				Lower	Upper	
Pretest Eksperimen - Posttest Eksperimen	-37.300	12.809	2.339	-42.083	-32.517	.000
Pretest Kontrol - Posttest Kontrol	-27.833	10.996	2.008	-31.939	-23.728	.000

Based on the results of the *paired-samples t-test*, the significance value (2-tailed) was 0.000. This result indicates a statistically significant difference between the mean *pretest* and *posttest* scores within the same group.

Table 11. *Independent Sample t-test*

Equal Variances Assumed	**Levene's Test for Equality of Variances**	**T-test for Equality of Means**
	Sig	**Sig. (2-tailed)**
	.803	.000

Based on the table, the significance value (2-tailed) was 0.000, indicating that the mean *posttest* scores of the control and experimental groups differed significantly. To determine the improvement in students' conceptual understanding, the N-Gain test was conducted because the control and experimental groups showed a statistically significant difference in their mean *posttest* scores.

Table 12. N-Gain Criteria

N-Gain Value	**Criteria**
(g) ≥ 0,70	High
0,30 > (g) < 0,70	Moderate
(g) < 0,30	Low

Based on the table, the N-Gain is classified into three criteria: high, moderate, and low. Therefore, descriptive N-Gain analysis was conducted to determine the

improvement in students' conceptual understanding following the implementation of augmented reality media based on Assemblr Edu.

Table 13. N-Gain

Group	Mean	Minimum	Maximum
Control	42.5226	9.52	93.62
Experimental	64.3499	30.23	100.00

Based on the table, the mean N-Gain scores of both groups were categorized as moderate. The control group's mean N-Gain score was 0.425, which was greater than 0.30, while the experimental group's mean N-Gain score was 0.643, which was less than 0.70.

Discussion

Based on the results above, it was found that the number of students in each group was 30. The learning process was conducted over four days, with the following details: on the first day, students were given a *pretest* consisting of twelve essay questions to determine their initial conceptual understanding. On the second and third days, students completed 2 lesson periods on the water cycle, covering its six stages, human activities that affect it, and efforts to preserve water resources. The control class used conventional media in the form of PowerPoint (PPT), whereas the experimental class received treatment using *augmented reality*. On the fourth day, students were given a *posttest* consisting of twelve essay questions to determine their conceptual understanding after the learning process. The implementation of learning in the control class using conventional PPT media was carried out well. Students participated well in the learning activities, paid attention to and understood the teacher's explanations, and exchanged ideas during discussions while completing the student worksheets (LKPD).

However, students' attention was often distracted because they became bored during the teacher's explanations; this could be addressed with *ice-breaking* activities and games. *Ice-breaking* activities stimulate students' motivation to learn (Wana et al., 2024). Overall, the experimental class followed the intended learning stages. First, *augmented reality* media were presented, and students analyzed the stages occurring in the *augmented reality* visualization. Education quality can improve when teachers keep up with current developments by integrating digital media into learning (Kuntari, 2023). Learning media deliver information by stimulating students' thoughts, feelings, and curiosity to motivate them, so the learning process can be achieved optimally (Daniyati et al., 2023). Second, the teacher explained the six stages of the water cycle in accordance with those displayed through AR. Third, during the discussion and question-and-answer session, students worked in groups to complete the LKPD and then presented their results to the class. IPAS learning encourages students' active participation through small-group formation and discussions with group members (Rahman & Fuad, 2023). The use of AR through the *Assemblr Edu* website proceeded well with the school's Wi-Fi support, allowing the media to be used without internet connectivity disruptions. Using digital media requires adequate school facilities, particularly a sufficient internet network (Nurhamidah et al., 2022).

Based on the *Paired Sample t-test* and *Independent Sample t-test results*, which obtained a significance value of 0.000, the mean conceptual understanding differed significantly between the control and experimental classes. A mean difference test can demonstrate the effect of learning media when the significance value is 0.000 (Masruroh et al., 2023). In addition, differences in conceptual understanding may have resulted from

several factors, including student absenteeism during the learning process. Several students did not participate in the learning activities on the second and third days. Students' physical condition also influenced their abilities because, when the *pretest* was administered, the students had previously completed a daily assessment. This aligns with Artadana, I Kt., Raga, Gd., and Pudjawan (as cited in Susilawati et al., 2024), who stated that students' physical activity should be considered because excessive activity can cause fatigue, whereas insufficient activity can cause boredom.

Furthermore, the N-Gain test indicated improved conceptual understanding. The control class obtained a mean N-Gain score of 0.425, with a minimum N-Gain score of 9.52 and a maximum N-Gain score of 93.62, whereas the experimental class obtained a mean N-Gain score of 0.643, with a minimum N-Gain score of 30.23 and a maximum N-Gain score of 100.00. Based on these results, it can be concluded that the improvement in students' conceptual understanding was in the medium category because the value was within the range of $0.30 \leq (g) < 0.70$. However, the difference was that more students in the experimental class were in the high category, and the highest score of 100 was obtained by one of the students in the experimental class. This finding aligns with Fauziah et al. (2022), who found that students' scores and curiosity were higher in the experimental class. Integrating *Augmented Reality* using *Assemblr Edu* has been shown to improve students' conceptual understanding of IPAS (Agustin et al., 2024). AR can make learning interactive and improve students' conceptual understanding by providing visual representations of conceptual processes (Hafis et al., 2024).

Based on these findings, it can be concluded that both *augmented reality* media based on *Assemblr Edu* and non-*augmented reality* media affected students' conceptual understanding. However, conceptual understanding improved more in the experimental class, with a 10-point difference in mean score. In addition, the improvement in conceptual understanding indicates that the experimental class, which received *augmented reality* treatment through the *Assemblr Edu* website, showed a greater effect. This is supported by the experimental class's higher mean *posttest* score, with the highest score at 100 and the lowest at 57. One factor contributing to the difference in *posttest* scores was that several students did not participate in the learning activities. In addition, students' attention was easily distracted, and their understanding of the material varied because some terms used to name the stages of the water cycle were unfamiliar to them.

This study still has several limitations. First, the sample size was limited. This study involved two different public elementary schools in Situraja District, which served as the control and experimental groups. Second, the AR media treatment was delivered over a relatively short period of two meetings, requiring students to understand the material within a limited time, while students differed in their pace of understanding. Third, AR media require an adequate internet connection, and in this study, students had not yet used the media independently through barcode scanning on their mobile phones. Fourth, the research material focused specifically on the water cycle, particularly its stages.

CONCLUSIONS AND SUGGESTIONS

Based on the research findings, it can be concluded that *Augmented Reality* based on *Assemblr Edu* affects elementary school students' conceptual understanding. The improvement in conceptual understanding is reflected in the higher N-Gain score obtained by the experimental class. However, both the control and experimental groups' posttest scores increased to approximately twice their respective *pretest* scores. Based on the *Paired Sample t-test results*, a significance value of 0.000 was obtained, indicating a significant difference between the mean *pretest* and *posttest* scores in each group.

Furthermore, the *Independent Samples t-test* resulted in a significance value (2-tailed) of 0.000, indicating that the mean *posttest* scores of the two groups were significantly different. These results indicate that the control and experimental groups were not equivalent; therefore, the N-Gain test was used to measure the improvement in students' conceptual understanding. The experimental class had a higher mean N-Gain score (0.643) than the control class (0.425). Based on these mean scores, it can be concluded that the improvement in students' conceptual understanding was in the medium category. These findings indicate that *Augmented Reality* based on *Assemblr Edu* affected students' conceptual understanding of the water cycle.

BIBLIOGRAPHY

Agustin, A., Aqua, H., Wardhani, K., & Sintang, U. K. (2024). Pengaruh Media Augmented Reality (AR) Berbantuan Assemblr Edu terhadap Hasil Belajar Siswa SMP IT. 5703. https://doi.org/10.51826/edumedia.v7i2.952

Anggriyani, U. W. (2024). Pengembangan Media Pembelajaran Interaktif Berbasis Augmented Reality untuk Meningkatkan Pemahaman Konsep IPA. Jurnal Pendidikan Dan Pembelajaran, 4(1), 28–33. https://doi.org/10.24114/jfi.v4i1.46127

Carolina, Y. Dela. (2022). Augmented Reality sebagai Media Pembelajaran Interaktif 3D untuk Meningkatkan Motivasi Belajar Siswa Digital Native. Ideguru: Jurnal Karya Ilmiah Guru, 8(1), 10–16. https://doi.org/10.51169/ideguru.v8i1.448

Daniyati, A., Saputri, I. B., Wijaya, R., Septiyani, S. A., & Setiawan, U. (2023). Konsep Dasar Media Pembelajaran. Journal of Student Research (JSR), 1(1), 282–294. https://doi.org/10.55606/jsr.v1i1.993

Dartiningsih, B. E. (2016). Gambaran Umum Lokasi, Subjek, Dan Objek Penelitian. Buku Pendamping Bimbingan Skripsi, 129, 135.

Farhan Arib, M., Suci Rahayu, M., Sidorj, R. A., & Win Afgani, M. (2024). Experimental Research Dalam Penelitian Pendidikan. Journal Of Social Science Research, 4, 5497–5511.

Fauziah, S. R., Sutisnawati, A., Nurmeta, I. K., & Hilma, A. (2022). Pengaruh metode eksperimen berbantuan media KIT IPA terhadap kemampuan literasi sains dan karakter rasa ingin tahu siswa sekolah dasar. Jurnal Cakrawala Pendas, 8(2), 457–467. https://doi.org/10.31949/jcp.v8i2.2283

Firdausa, Rossa Ayudyah Darmawan, P. (2024). Motivasi Belajar Siswa Sekolah Dasar Pada Mata Pelajaran IPAS Menggunakan Media Pembelajaran Augmented Reality (AR). Jurnal Cerdik: Jurnal Pendidikan Dan Pengajaran, 4(1), 26–35. https://doi.org/10.21776/ub.jcerdik.2024.004.01.04

Hafis, Buhaerah, & Kasmirah. (2024). Implementasi media pembelajaran berbasis augmented reality untuk meningkatkan pemahaman konsep geometri siswa. DIKMAT: Jurnal Pendidikan Matematika, 5(2), 1–8. https://doi.org/10.56842/dikmat.v5i02.331

Ilham, I., Pujiarti, T., Ramadhan, S., & Wulan, W. (2024). Analisis Kesulitan Siswa dalam Pembelajaran IPAS di SDN 27 Dompu. Jurnal Pendidikan Dan Pembelajaran Indonesia (JPPI), 4(3), 919–929. https://doi.org/10.53299/jppi.v4i3.603

Janah, F. N. M., Nuroso, H., Mudzanatun, & Isnuryantono, E. (2023). Penggunaan Aplikasi Canva dalam Media Pembelajaran Matematika di Sekolah Dasar. Jurnal Pendidikan Dasar.

Khaira, A. U., Hermita, N., & Alim, J. A. (2025). Efektivitas media pembelajaran augmented reality Assemblr Edu pada pembelajaran IPAS untuk meningkatkan keterampilan berpikir kreatif siswa SD kelas V. Jurnal Jendela Pendidikan, 01(02), 260. https://www.ejournal.jendelaedukasi.id/index.php/JJP/article/view/6

Kristiana, T. F., & Radia, E. H. (2021). Meta analisis penerapan model problem based learning dalam meningkatkan hasil belajar IPA siswa sekolah dasar. Jurnal Basicedu, 5(5), 3(2), 524–532. https://journal.uii.ac.id/ajie/article/view/971

Kuntari, S. (2023). Pemanfaatan media digital dalam pembelajaran. Prosiding Seminar Nasional Fakultas Tarbiyah Dan Ilmu Keguruan IAIM Sinjai, 2, 90–94. https://doi.org/10.47435/sentikjar.v2i0.1826

Masruroh, H., Hadi, W. P., Ahied, M., Tamam, B., & Chandra, M. (2023). Efektivitas Penggunaan Media Pembelajaran Berbasis Augmented Reality terhadap Pemahaman Konsep Siswa. Jurnal Natural Science Educational Research, 6(3), 56–63.

Novanto, Y. S., Anitra, R., & Wulandari, F. (2021). Pengaruh model pembelajaran POE terhadap kemampuan pemahaman konsep IPA siswa SD. ORBITA: Jurnal Pendidikan dan Ilmu Fisika, 7(1), 205-211. https://doi.org/10.31764/orbita.v7i1.4665

Nurhamidah, S. D., Sujana, A., & Karlina, D. A. (2022). Pengembangan Media Berbasis Android pada Materi Sistem Tata Surya untuk Meningkatkan Penguasaan Konsep Siswa. 8(4), 1318–1329. https://doi.org/10.31949/jcp.v8i4.3190

Prayogi, A., Arif Kurniawan, M., & Abdurrahman Wahid Pekalongan, U. K. (2024). Pendekatan kualitatif dan kuantitatif: suatu telaah. Complex : Jurnal Multidisiplin Ilmu Nasional, 1(2), 30–37. https://doi.org/10.66341/complex.v1i2.7

Purwanti, P., Diana, R., Mulyadin, M., Yusup, F., & Fauzi, R. N. (2024). Penggunaan Media Augmented Reality dalam Pembelajaran IPA untuk Meningkatkan Pemahaman Konsep. Jurnal Informatika Dan Teknologi Pendidikan, 4(2), 67–73. https://doi.org/10.59395/jitp.v4i2.98

Qorimah, E. N., & Sutama. (2022). Studi literatur: media augmented reality (AR) terhadap hasil belajar kognitif. Jurnal Basicedu, 43(4), 281–286. https://doi.org/10.31004/basicedu.v6i2.2348

Rahman, R., & Fuad, M. (2023). Implementasi Kurikulum Merdeka Belajar Dalam Pembelajaran Ipas Di Sekolah Dasar. DISCOURSE: Indonesian Journal of Social Studies and Education, 1(1), 75–80. https://doi.org/10.69875/djosse.v1i1.103

Rinaldi, R., Fahmi, K., & Masyitah, M. (2024). Tinjauan Literatur: Pemanfaatan Teknologi Augmented Reality sebagai Media Pembelajaran Interaktif Di Tingkat Sekolah Dasar. Likhitaprajna Jurnal Ilmiah Fakultas Keguruan Dan Ilmu Pendidikan Universitas Wisnuwardhana, 26(1), 20–28. https://doi.org/10.37303/likhitaprajna.v26i1.279

Shofiyah, N., Ali, E. Y., & Sujana, A. (2024). Peran Pembelajaran Berbasis Proyek dalam Meningkatkan Kreativitas Siswa Kelas V Materi Rantai Makanan. Al-Madrasah Jurnal Pendidikan Madrasah Ibtidaiyah, 8(4), 1893. https://doi.org/10.35931/am.v8i4.4097

Susilawati, A., Sujana, A., & Ali, E. Y. (2024). Pengembangan Pop-up Book Digital untuk Meningkatkan Pemahaman Konsep Kelas IV Materi Bagian Tumbuhan dan Fungsinya. Ideguru: Jurnal Karya Ilmiah Guru, 10(1), 158–164. https://doi.org/10.51169/ideguru.v10i1.1426

Ummah, K. K., & Mustika, D. (2024). Analisis Penggunaan Media Pembelajaran Pada Muatan IPAS di Kelas IV Sekolah Dasar. Didaktika: Jurnal Kependidikan, 13(2), 1573-1582. https://doi.org/10.58230/27454312.709

Wana, P. R., Ruchiyat, M. G., & Nurhidayah, S. (2024). Pengaruh Ice Breaking terhadap Motivasi Belajar Siswa. 4(01), 110–124. https://doi.org/10.57008/jjp.v4i01.698

Yusup, A. H., Azizah, A., & Rejeki, E. S. (2023). Literature Review : Peran Media Pembelajaran Berbasis Augmented Reality Dalam Media Sosial. Jurnal Pendidikan Indonesia: Teori, Penelitian Dan Inovasi, 3(5). https://doi.org/10.59818/jpi.v3i5.575