THE EFFECTIVENESS OF AUGMENTED REALITY AS LEARNING MEDIA FOR STUDENTS WITH INTELLECTUAL DISABILITIES

Elma Fatikha Afif[1], Ulfa Wulan Agustina[2], Nurul Afidah[3], Yuyun Bachtiar[4]

[1234]Universitas KH. Wahab Hasbullah

afifelma18@gmail.com[1], ulfa.wulanagustina@unwaha.ac.id[2]

Abstract

The purpose of this research is to ascertain whether Augmented Reality (AR) is a useful learning tool for helping students with intellectual disabilities recognize animal names and whether a rise in the average score of these students occurs. A new technology that mixes two- and three-dimensional items with information in a true projection is called Augmented Reality (AR). The researchers employed pre-experimental design and experimental research approaches in this work. As tools for gathering data, the researcher performed tests and observations twice at each meeting. According to SLB Muhammadiyah Jombang research, Augmented Reality (AR) significantly enhances learning for students with intellectual disabilities, particularly when it comes to identifying animal names. Following the use of Augmented Reality (AR), the average pre-test score rose to 73.87, while the post-test score rose to 88.50. High levels of involvement and enthusiasm were evident during the Augmented Reality (AR) lecture, according to observation results. Augmented Reality (AR) has a good influence on student attention and engagement, as evidenced by the N-Gain formula's effectiveness score of 64.06%. For students with intellectual disabilities, Augmented Reality (AR) is a useful tool to improve their educational experience.

Keywords: Augmented Reality; Learning Media; Intellectual Disabilities

Abstrak

Tujuan dari penelitian ini adalah untuk memastikan apakah Augmented Reality (AR) merupakan alat pembelajaran yang berguna untuk membantu siswa dengan disabilitas intelektual dalam mengenali nama-nama hewan dan apakah ada peningkatan nilai rata-rata siswa tersebut. Teknologi baru yang menggabungkan benda-benda dua dan tiga dimensi dengan informasi dalam proyeksi nyata disebut Augmented Reality (AR). Peneliti menggunakan desain pra-eksperimental dan pendekatan penelitian eksperimental dalam penelitian ini. Sebagai alat untuk mengumpulkan data, peneliti melakukan tes dan observasi sebanyak dua kali pada setiap pertemuan. Menurut penelitian di SLB Muhammadiyah Jombang, Augmented Reality (AR) secara signifikan meningkatkan pembelajaran bagi siswa dengan disabilitas intelektual, terutama dalam hal mengidentifikasi nama-nama hewan. Setelah penggunaan Augmented Reality (AR), nilai rata-rata pre-test naik menjadi 73,87, sedangkan nilai post-test naik menjadi 88,50. Tingkat keterlibatan dan antusiasme yang tinggi terlihat jelas selama kuliah Augmented Reality (AR) berlangsung, menurut hasil observasi. Augmented Reality (AR) memberikan pengaruh yang baik terhadap perhatian dan keterlibatan mahasiswa, dibuktikan dengan nilai efektivitas rumus N-Gain sebesar 64,06%. Bagi siswa dengan disabilitas intelektual, Augmented Reality (AR) adalah alat yang berguna untuk meningkatkan pengalaman pendidikan mereka.

Kata kunci: Augmented Reality (AR); Media Pembelajaran; Disabilitas Intelektual

INTRODUCTION

Augmented reality (AR) is a new technology that involves overlaying the real world with computer graphics (Gershon, 2001). Sutopo said that Augmented reality (AR) realizes a virtual environment by adding virtual information to the physical real environment. Augmented reality (AR) not only adds virtual information to real environments but also streams videos and games, providing a simpler look (Fitria, 2023). In other words, Augmented Reality (AR) emerges as the new technology that combines 2-dimensional/ 3-dimensional objects which contains information in a real projection.

The use of Augmented Reality (AR) covers multiple aspect of human life, such as; entertainment, education, e-commerce, navigation, and digital industry. In education, Augmented Reality (AR) is often used as the learning media (see Molnár et al, 2018; Wahyuanto et al, 2024; Athiyah et al, 2024). In e-commerce, Augmented Reality is also massively utilized to improve its performance (see Chodak, 2024; Susanto et al, 2025; and Kembau et al, 2025). In digital industry, Augmented Reality showed its positive impact towards industrial area (see Jiman & Kulal, 2023; Hidayah et al, 2023; and Chen, 2022).

Previous studies have also proved that Augmented Reality (AR) become the concern of many scholars, especially in educational setting. Athiyah et al (2024) focused on investigating the use of Augmented Reality (AR) to improve students' memory in science learning at the primary level. Heydemans & Elmunsya (2024) did a systematic literature review on the use of Augmented Reality (AR) as learning media. Melliofatria (2024) investigates the impact of Augmented Reality (AR) on material comprehension.

Considering the positive impact of the use Augmented Reality (AR) the researcher belived that it can help the learning process of students, including the students with intellectual disabilities. Intellectual disabilities are characterized by severe intellectual limitations in functional and adaptive behaviors expressed in conceptual, social, and practical adaptive skills. Commonly, this disability occurs before the age of 18 (Damastuti, 2020).

In one of the previously observed schools, researchers are interested in testing the use of Augmented Reality (AR) as a learning tool for kids with intellectual disabilities. A third-grade student with intellectual difficulties was observed. According to the findings of these investigations, two-dimensional media are primarily used in student learning. Therefore, research utilizing Augmented Reality (AR) as a teaching tool for third-grade students with intellectual disabilities are of interest to researchers. In order for students to fully comprehend the physical characteristics of the animals displayed, the teacher can use Augmented Reality (AR) to display realistic-looking animal photographs that can be rotated and enlarged or decreased in size.

METHOD

The researchers employed a one-group pre-test-post-test approach and a quantitative pre-experimental design. There was no control or comparison group used in this one-group pretest and posttest design. Six observations are made in the pre-test and post-test groups: one before treatment is administered, known as the pre-test, and one after treatment is administered, known as the post-test. The population in this research was the third grade of the students at SLB Muhammadiyah Jombang, in which the total

of third class is two classes, and this research was conducted just in one class. In this research, the researchers use one class of A class as a sample for this research, which consists of 8 students.

This research uses two instruments to collect data, those are a test and an observation. The design is referred to as a pre-posttest. The test is employed since it is a tool that the researcher utilizes for this study. The second instrument used by researcher is observation. The researcher made observations over six meetings, each lasting an hour. The researcher directly observed the teacher-led learning process during the first meeting. After that, the researcher administered a post-test to the students in order to determine the scores of the students who had not received treatment. In the second and third sessions of the first week, as well as the fourth and fifth meetings of the second week, the researcher personally treated students with intellectual disabilities by employing Augmented Reality (AR) as a learning media. Following the administration of four treatments, the researcher administered a pre-test at the final meeting to evaluate the learning outcomes. The dependent sample t-test from SPSS is used by the researchers to examine the data.

This test is employed when there is just one sample that has completed two tests. To obtain the data, the researcher used SPSS 30. The formula of the dependent sample t-test is as follows:

$$t = \frac{\bar{d}}{S_d / \sqrt{n}}$$

Explanation
- D = average of the difference between two measurements
- Sd = standard deviation of the measurement difference
- n = number of data pairs

To determine the effectiveness of Augmented Reality (AR), researchers used the N-Gain. N-Gain formula as follows:

$$N_{Gain} = \frac{Post\,Test\,Score - Pre\,Test\,Score}{Ideal\,Score - Pre\,Test\,Score}$$

FINDINGS AND DISCUSSION

The following will be displayed the results of the pre-test and post-test, test of normality, and description of the calculation of the effectiveness of augmented reality as a learning medium for SLB Muhammadiyah students with the dependent t-test formula using SPSS 30:

Table 1: Pre and post-test results

No	Name	Pre Test	Scale of Pre-Test Score	Post Test	Scale of Post Test Score
1	Fikri	58	Good	83	Good
2	Bahari	83	Good	100	Good
3	Noval	75	Good	83	Good
4	Caca	75	Good	92	Good
5	Zafran	50	Fair	66	Good
6	Sabrina	75	Good	92	Good
7	Alicya	92	Good	100	Good
8	Roni	83	Good	92	Good

The Result of Paired Sample T-Test Using SPSS

The following is the result of calculating the paired sample test using SPSS 30 to determine whether there is an increase in the average student score before and after treatment.

Table 2: Test of normality

	Kolmogorov-Smirnova			Shapiro-Wilk		
Tests of Normality						
	Statistic	df	Sig.	Statistic	df	Sig.
Pre Test	.305	8	.027	.851	8	.097
Post Test	.248	8	.157	.873	8	.161

The normalcy can be checked using the one-sample Shapiro-Wilk method. The reasoning behind the choice is that if the t-statistic probability value is higher than the significant level of 0.05, the regression model satisfies the assumption of normalcy.

The results of the normality test with one sample Shapiro-Wilk above demonstrate that the data meets the assumption of normalcy. The t-statistic's probability value is greater than the significance level of 0.05.

Table 3: The results of paired sample statistic

Paired Sample Statistics				
Pair 1	**Mean**	**N**	**Std. Deviation**	**Std. Error Mean**
Pre Test	72.8750	8	15.26375	5.39655
Post Test	88.5000	8	11.13553	3.93700

The descriptive statistics of the pre-test and post-test data are summarized in this output.

Table 4: The correlation between two variables

Pair Sample Correlation			
Pair 1	N	Correlation	Sig.
Pre Test & Post Test	8	.854	.007

In the context of a paired t-test, a correlation analysis is performed to see how strong the relationship is between two variables (e.g., before and after scores). A high correlation value (close to 1 or 1) indicates a strong relationship, while a low p-value (e.g., <0.05) indicates that the relationship is statistically significant.

In this Paired Sample Correlation test, the p-value is less than 0.05, so we can conclude that there is a significant relationship between these variables.

Table 5: Table of paired sample T-test

Paired Samples Test

Pair 1	Paired Differences					t	df	Sig. (two-tailed)
Pre Test - Post Test	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
	15.62500-	8.17553	2.89049	-22.45991	-8.79009	-5.406	7	.001

Paired Samples Test

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Basis for Decision

a) If the Sig value. (2-tailed) value is less than 0.05, then there is a significant difference between the learning outcomes on the pre-test and posttest data.

b) If the Sig. (2-tailed) value is more than 0.05, then there is no significant difference between the learning outcomes in the pre-test and post-test data.

It is known that the Sig. (2-tailed) of 0.000 <0.05, it can be concluded that there is a significant difference between the learning outcomes in the pre-test and post-test data.

The Result of N Gain Using SPSS 30

The outcome of using SPSS 30 to calculate N gain in order to assess the efficacy of Augmented Reality (AR) as a teaching tool for students with intellectual disabilities is as follows.

Table 6: Result of N-gain

No	Pre Test	Post Test	N - Gain	Improvement	(%) N- Gain
1	58.00	83.00	.66	Moderate	66
2	83.00	100.00	1.00	High	100
3	75.00	83.00	.68	Moderate	68
4	75.00	92.00	.32	Moderate	32
5	50.00	66.00	.32	Moderate	32
6	75.00	92.00	.68	Moderate	68
7	92.00	100.00	1.00	High	100
8	83.00	92.00	.53	Moderate	53

Table 7: N-Gain average score

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
N-gain	8	.32	1.00	.6487	.26165
Valid N (listwise)	8				

Six out of eight students are now in the "Moderate" group, according to the analytical results that are compiled in Table 4.5. Two out of every eight students fall into the "High" group. The N-gain average score of 0.640 falls into the category of "Moderate" understanding improvement overall.

Table 8: Percentage of N-Gain

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Percent	8	32	100	64.87	26.165
Valid N (listwise)	8				

Determination of the effectiveness of the application of *Augmented Reality* (AR) as a learning medium for students with intellectual disability can be seen from the percentage of N-Gain obtained, by 64.87% and included in the effective category.

CONCLUSION

Based on the analysis, students can learn the animal's name with the use of Augmented Reality (AR). This is demonstrated by the observation that after receiving treatment, the average pre-test score of the students rose from 72.87 to 88.50 on the post-test. It can also be seen from the results of observations that they are more enthusiastic and excited when learning by using Augmented Reality (AR) this has been explained by the previous researcher who said that this research shows that using Augmented Reality (AR) technology in the education sector as an alternative learning media provides many benefits for students, teachers and parents. This application can increase students' interest in animals and reduce students' boredom in class by making students more active and involved in the learning process. (Pangestu et al., 2024)

The percentage of N-Gain obtained, which is 64.87% and falls into the effective group, shows the findings of completeness and may be used to assess the efficacy of researchers employing the N-Gain formula. Therefore, when used under the supervision and guidance of parents at home and teachers at school, augmented reality is a fun and effective learning tool for students with special needs.

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