



The Utilization of Augmented Reality to Improve The Interpersonal Intelligence of Elementary School Students

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Abstract. Augmented Reality (AR) is a type of learning media that combines virtual and real worlds in real time. This research aimed to determine the use of AR on the interpersonal intelligence skills of elementary school students. This research used a quasi-experimental method using a post-test-only control group design, and the participants were 30 elementary school students in Jakarta. Data was collected through an observation form consisting of 12 items. In this research, an AR-based application was designed to visualize the universe consisting of 15 objects. This research showed that students' interpersonal intelligence increased significantly after learning treatment using Augmented Reality (AR) based applications.

Keywords: Augmented reality, interpersonal intelligence, science learning, multimedia learning, elementary school.

1 Introduction

Currently, the rapid development of science and technology has a significant impact on human life, including in the field of education [33, 37]. Therefore, this acceleration must be proportional to the supporting facilities so that student's interest in participating in the learning process increases. In the learning process, teachers cannot be separated from the learning model and media [10, 34]. Learning media is a learning resource that can assist teachers in enriching students' insights [20, 49]. Using learning media can foster student interest in learning new things in the material presented by the teacher so that it can be easily understood. Interesting and up-to-date learning media can be a stimulus for students in the learning process [39, 45]. Therefore, as a teacher, he must be able to choose appropriate and suitable learning media so that the teaching objectives set by the school are achieved [25, 38].

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Various media have been developed to make the learning process more interesting. The development of media year to year has developed from conventional learning media (i.e., teaching aids) to modern learning media (Augmented Reality, Virtual Reality, Metaverse, etc.). Figure 1 shows several types of learning media.

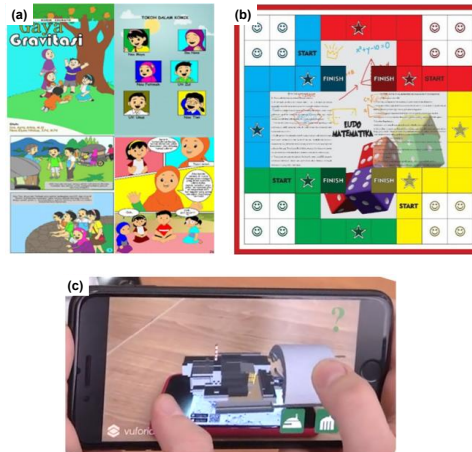


Fig. 1. Several types of learning media: (a) comic [28]; (b) Ludo [24]; and (c) Augmented Reality [21].

One of the media that is currently developing is augmented reality (AR) based learning media. AR is a type of learning media that combines the virtual and real worlds in a real-time [46]. AR technology is suitable for use as a learning medium because it provides a real learning experience for students [16]. By getting real-life learning experiences during the learning process, students become more enjoyable than before. Various learning media based on AR have been developed in many different courses, including mathematics [5, 6], science [11, 41], language [8, 31], social science [42], civic education [47], etc. On the other hand, the use of this technology significantly impacted the student's ability in the learning process. The use of augmented reality in the learning process can improve student achievement and have a positive impact on student attitudes [11, 36]. This technology could also improve 21st-century students' abilities, namely critical thinking ability [9, 40], problem-solving ability [7, 26], Communication ability [12], and collaboration [14].

In addition to 21st-century abilities, other things affect student success in the learning process, namely interpersonal intelligence. Interpersonal intelligence is the ability to understand the thoughts, attitudes, and behaviors of others and the ability to respond effectively to various signals between individuals [18, 48]. Interpersonal intelligence has three dimensions: social sensitivity, social insight, and social communication [1, 43]. The characteristics of students with high interpersonal intelligence will consistently demonstrate the ability to develop effective social relationships, empathy for others, maintain social relationships, sensitivity to social situations, good problem-solving abilities, prevent problems in social relations, and effective communication skills and

abilities [35]. Interpersonal intelligence has a significant influence on students. According to research from Istapra et al., students with high interpersonal intelligence students tend to get good learning achievements [23]. In addition, someone who has good interpersonal intelligence tends to get a job faster than others [44].

There are several factors that influence the increase in children's Interpersonal Intelligence, both internally and externally. Internal factors that influence children's interpersonal improvement include genetics, heredity, psychology, and health. At the same time, external factors are the parenting patterns of parents and the environment (such as learning in schools that do not only prioritize academics, etc.) [19]. Some of the factors causing the decline in children's interpersonal intelligence, among others, are learning activities carried out by teachers who prioritize academic intelligence, such as counting, learning to read, and writing which are the demands of parents and children tend to do assignments individually, teachers do not provide opportunities for children to work together. in a group, lack of honing children's abilities in sensitivity. Sympathy and Empathy of children toward others and teachers do not set rules in behavior. In addition, dependence on something makes children not independent and cannot solve their own problems [3].

From the facts that have been described, there needs to be a way to be able to provide opportunities for students to discuss and be independent in doing the learning. On the other hand, AR is one of the media that is suitable for use in the learning process because it provides opportunities for students to study independently and discuss what they have seen through the media. From the information that researchers know, no research looks at the effect of augmented reality learning media on interpersonal intelligence. Therefore, researchers researched the use of augmented reality to improve the interpersonal intelligence skills of elementary school students.

2 Method

2.1 Research Design

The quasi-experiment using a post-test-only control group design was used in this research. Quasi-experimental research compares outcomes between groups of interventions in which, for ethical or feasibility reasons, participants are not randomized to the respective interventions [2]. The research design is shown in table 1.

Table 1. The research design of post-test experimental design [27]

Treatment	Post-test
X ₁	O ₁
X ₂	O ₂

Information:

O₁: the result of the post-test experiment class

O₂: the result of the post-test control class

X₁: learning using augmented reality

X₂: conventional learning

2.2 Participants

This research population was six-grade students in the SD Negeri Pondok Bambu 06 Jakarta, and the sample was selected using a random sampling method. Simple random sampling is a method of choosing a sample s of n units from a population Ω of size N by giving equal selection probabilities for all units [4]. The 30 six-grade students became the sample that was divided into experiment and control classes, with each about 15 students.

2.3 Research Instrument

The instruments used in this study were an interpersonal intelligence form and a post-test in the form of oral questions. Students were given during the learning process, the experimental class was given an augmented reality application as an addition to the learning process, while the control class was only given conventional learning. At the end of the lesson, each student was given a question related to the material, which was answered orally.

2.4 Data Analysis

The data was analyzed by using an independent sample t-test. The Independent sample t-test is a parametric test used to determine whether there is a difference in the mean between two independent groups or two unpaired groups with the intention that the two groups of data come from different subjects [13]. The hypothesis used in this study is as follows:

H₀ : There was no difference in the average result of students' interpersonal intelligence between the experimental class and the control class

H_a : There was no difference in the average result of students' interpersonal intelligence between the experimental class and the control class

3 Result and Discussion

In this research, the developed learning media, namely PhysAR was used as the learning media. This android application provided a real learning experience about space subjects for students and made the learning process more interesting than before. Figure 2 shows the illustration of the PhysAR.

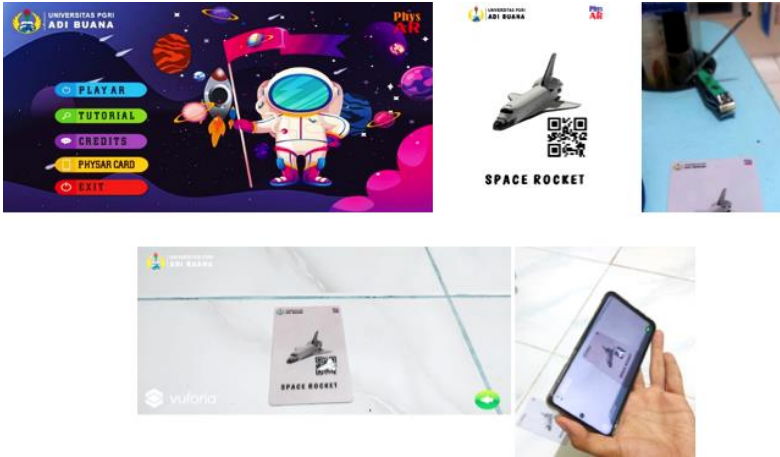


Fig. 2. The PhysAR illustration

3.1 Similarity Initial Test

The similarity initially of the samples using the two-tailed t-test was used to know the capability of each sample before the research began. A similar initial sample used normality and homogeneity tests for each class. The Lilliefors method with a significance level (α) of 5% was used to know the normality of the sample, and the results are presented in Table 2.

Table 2. The Normality test result

Sample Class	Lobservation	Ltable
Experimental Class	0.198	0.220
Control Class	0.185	0.220

Based on Table 2 shows that the $L_{observation} < L_{table}$ in each class. This condition indicates that the sample of the experimental and control classes is normally distributed. On the other hand, the results of the homogeneity test using Bartlett's method show that X^2_{count} had a lower value than X^2_{table} ($X^2_{count} = 0.219 < X^2_{table} = 3.841$). This indicates that the two samples come from homogeneous populations.

3.2 Hypothesis Testing Result

The comparative method for the free sample (independent sample t-test) was used to test the hypothesis. The observation interpersonal intelligence result scores for both the experimental class and control class were used as data and were calculated at a significant level of 5%. The results of the hypothesis test are shown in Table 3.

Table 3. The Comparative test result data for free samples.

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Result Test	Equal variances assumed	3.353	.078	2.383	28	0.24	9.60000	4.02786	1.34930	17.85070
	Equal variances not assumed			2.383	23.273	0.26	9.60000	4.02786	1.27314	17.92686

Table 3 shows that the F count of Levene's test was 3.353, with a significant level of 0.078. Since the significant result has a value greater than 0.05 ($0.078 > 0.050$), it can conclude that the variance is the same. Therefore, t-test analysis using the assumption of equal variance is assumed. Based on the equal variances assumed section showed that the t value of the data is 2.383, which is greater than t_{table} ($t_{count} = 2.383 > t_{table} = 1.697$). This indicates that H_0 was rejected and H_a was accepted. On the other hand, the significance value is $0.024 < 0.050$, which interprets there was a difference in the average results of students' problem-solving abilities between the experimental class and the control class.

3.3 Discussion

From the data presented, it can be seen that the addition of augmented reality learning media, can improve students' interpersonal intelligence abilities. One of the factors that influence students' interpersonal intelligence is the school environment [18]. One of the factors that influence students' interpersonal intelligence is the school environment where teachers can provide space for students to discuss and be independent in doing the learning. Augmented Reality is one of the media that is suitable for use in the learning process because it provides opportunities for students to study independently and discuss what they have seen through the media. Augmented Reality is a technology that combines the virtual and the real world in a real-time [22].

There are several studies that confirm that the use of appropriate learning media can improve students' interpersonal intelligence ability. In research, Eva et.al. stated that the use of the Labyrinth Game learning media can Improve Children's Interpersonal Intelligence. By utilizing the labyrinth game, students are given the opportunity to work together in groups and hone their sensitivity skills [17]. Putri et.al. The research also states that providing treasure hunt game learning media can improve students' interpersonal intelligence [32]. Then, Hanafiah et al. states that the development of a Game Model Based on a Cultural Values Approach can increase Interpersonal Intelligence [15].

In addition, Osadchyi et.al. conducting research on the use of augmented reality technology in the development of interpersonal intelligence. From the results of his research, it is stated that the use of augmented reality can have an impact on the development of students' interpersonal intelligence [29]. This is in line with the research of Papoutsi et.al. which states that learning media based on Virtual and Augmented Reality can Develop Interpersonal Intelligence Skills [30]. From some of these studies, it can be seen that the use of appropriate learning media can improve students' interpersonal intelligence according to the results of this study. XX

4 Conclusion

The results showed that the addition of AR media was effective in improving students' interpersonal intelligence in the learning process. These results are supported by the results of the independent t-test where H_0 is rejected, and H_a is accepted. With these results, it could be interpreted that there was a difference in the average results of students' interpersonal intelligence between the experimental class and the control class. The increase here was because the use of Augmented Reality Media could make it easier for students to visualize the phenomena that occur so that students can easily describe learning outcomes. In addition, Augmented Reality media also makes it easier for students to understand complex concepts and visualize abstract concepts to understand and structure an object model. The implication of this research is to provide an illustration that the learning media used can affect students' interpersonal intelligence abilities. Some recommendations that need to be considered for further research are the modification of the learning media that has been used so that it is more interactive, which can improve students' interpersonal intelligence abilities. In addition, integration with the right learning model needs to be done so that the increase in interpersonal intelligence abilities is maximized

References

1. Abas, M. and Solihatin, E. 2019. Effect of Instructional Models and Interpersonal Intelligence on the Social Studies Learning Outcomes. *International Journal of Instruction*. 12, 4 (2019), 705–718.
2. Andrade, C. 2021. The limitations of quasi-experimental studies, and methods for data analysis when a quasi-experimental research design is unavoidable. *Indian Journal of Psychological Medicine*. 43, 5 (2021), 451–452.
3. Armstrong, T. 2009. *Multiple intelligences in the classroom*. Ascd.
4. Augusto Taconeli, C. and Rodrigues de Lara, I.A. 2022. Discrete Weibull distribution: different estimation methods under ranked set sampling and simple random sampling. *Journal of Statistical Computation and Simulation*. 92, 8 (2022), 1740–1762.
5. Cai, S. et al. 2020. Probability learning in mathematics using augmented reality: impact on student's learning gains and attitudes. *Interactive Learning Environments*. 28, 5 (2020), 560–573.

6. Cheng, Y.-W. et al. 2019. An in-depth analysis of the interaction transitions in a collaborative Augmented Reality-based mathematic game. *Interactive Learning Environments*. 27, 5–6 (2019), 782–796.
7. Chiang, T.H. et al. 2014. Students' online interactive patterns in augmented reality-based inquiry activities. *Computers & Education*. 78, (2014), 97–108.
8. Fan, M. et al. 2020. Augmented reality for early language learning: A systematic review of augmented reality application design, instructional strategies, and evaluation outcomes. *Journal of Educational Computing Research*. 58, 6 (2020), 1059–1100.
9. Faridi, H. et al. 2021. A framework utilizing augmented reality to improve critical thinking ability and learning gain of the students in Physics. *Computer Applications in Engineering Education*. 29, 1 (2021), 258–273.
10. Febriyanti, R.H. et al. 2022. Utilizing Learning Management System in Online Writing Instruction in Higher Education: Indonesian Faculty Member Perspectives. *Journal of Higher Education Theory and Practice*. 22, 10 (2022), 79–96. DOI:<https://doi.org/10.33423/jhetp.v22i10.5388>.
11. Fidan, M. and Tuncel, M. 2019. Integrating augmented reality into problem based learning: The effects on learning achievement and attitude in physics education. *Computers & Education*. 142, (2019), 103635.
12. Furió, D. et al. 2015. Mobile learning vs. traditional classroom lessons: a comparative study. *Journal of Computer Assisted Learning*. 31, 3 (2015), 189–201.
13. Gao, Y. et al. 2018. Excel and SPSS analysis of independent sample t-test. *Animal Husbandry and Feed Science (Inner Mongolia)*. 39, 10 (2018), 79–82.
14. Han, J. et al. 2015. Examining young children's perception toward augmented reality-infused dramatic play. *Educational Technology Research and Development*. 63, 3 (2015), 455–474.
15. Hanafiah Hanafiah et al. 2018. Game Model Based on Cultural Values Approach in Developing Interpersonal and Kinesthetic Intelligences in Early Childhood. *Proceedings of the 4th International Conference on Early Childhood Education. Semarang Early Childhood Research and Education Talks (SECRET 2018)* (Nov. 2018), 1–7.
16. Harefa, E. et al. 2019. Visualization of conduction heat transfer using augmented reality technology. *Indian J Sci Technol*. 12, 21 (2019), 1–6.
17. Heavy Evasari et al. 2017. The Effectiveness of Labyrinth Game in Improving Interpersonal Intelligence of Children with Autism. *Proceedings of the 3rd International Conference on Education and Training (ICET 2017)* (Sep. 2017), 199–202.
18. Herpertz, S.C. 2022. Interpersonal intelligence. *Intelligence-Theories and Applications*. Springer. 147–160.
19. Herpertz, S.C. 2022. Interpersonal intelligence. *Intelligence-Theories and Applications*. Springer. 147–160.
20. Iasha, V. et al. 2020. The Traditional Games Effect on Improving Students Working Memory Capacity in Primary Schools. (2020), 1–5.
21. Iatsyshyn, A.V. et al. 2020. Application of augmented reality technologies for preparation of specialists of new technological era. (2020).
22. Ibáñez, M.-B. and Delgado-Kloos, C. 2018. Augmented reality for STEM learning: A systematic review. *Computers & Education*. 123, (2018), 109–123.
23. Istapra, E. et al. 2021. Interpersonal Intelligence: A Strengthening in Efforts to Improve Student Learning Achievement. *Education Quarterly Reviews*. 4, 2 (2021).
24. Izzaty, A.D. and Nurfitriani, M. 2021. Pengembangan Media Pembelajaran Permainan Ludo Pada Materi Operasi Pengurangan Kelas 3 MIS Sindangraja. *Buana Pendidikan: Jurnal Fakultas Keguruan dan Ilmu Pendidikan Unipa Surabaya*. 17, 1 (2021), 33–41.

25. Kencono, M.R. and Ratnasari, E. 2021. The Influence of Learning Media on Student Activity: Bahasa Indonesia. *Buana Pendidikan: Jurnal Fakultas Keguruan dan Ilmu Pendidikan Unipa Surabaya*. 17, 2 (Oct. 2021), 175–181. DOI:<https://doi.org/10.36456/bp.vol17.no2.a4393>.
26. Lin, C.-Y. et al. 2016. Augmented reality in educational activities for children with disabilities. *Displays*. 42, (2016), 51–54.
27. Marsden, E. and Torgerson, C.J. 2012. Single group, pre- and post-test research designs: Some methodological concerns. *Oxford Review of Education*. 38, 5 (Oct. 2012), 583–616. DOI:<https://doi.org/10.1080/03054985.2012.731208>.
28. Ntobuo, N.E. et al. 2018. The development of gravity comic learning media based on Gorontalo culture. *Jurnal Pendidikan IPA Indonesia*. 7, 2 (2018), 246–251.
29. Osadchyi, V.V. et al. 2021. The use of augmented reality technologies in the development of emotional intelligence of future specialists of socioeconomic professions under the conditions of adaptive learning. (2021).
30. Papoutsis, C. et al. 2021. Virtual and augmented reality for developing emotional intelligence skills. *Int. J. Recent Contrib. Eng. Sci. IT (IJES)*. 9, 3 (2021), 35–53.
31. Parmaxi, A. and Demetriou, A.A. 2020. Augmented reality in language learning: A state-of-the-art review of 2014–2019. *Journal of Computer Assisted Learning*. 36, 6 (2020), 861–875.
32. Putri, P.P. et al. 2020. Pengaruh Permainan Treasure Hunt Terhadap Kecerdasan Interpersonal Anak Usia 5-6 Tahun. *Jurnal Paud Agapedia*. 4, 1 (2020), 118–130.
33. Rachmadtullah, R. et al. 2020. The Challenge Of Elementary School Teachers To Encounter Superior Generation In The 4.0 Industrial Revolution: Study Literature. *International Journal of Scientific & Technology Research*. 9, 4 (2020), 1879–1882.
34. Richert, R.A. et al. 2011. Media as social partners: The social nature of young children's learning from screen media. *Child development*. 82, 1 (2011), 82–95.
35. Sadiku, M.N. and Musa, S.M. 2021. Intrapersonal intelligence. *A Primer on Multiple Intelligences*. Springer. 95–106.
36. Sahin, D. and Yilmaz, R.M. 2020. The effect of Augmented Reality Technology on middle school students' achievements and attitudes towards science education. *Computers & Education*. 144, (2020), 103710.
37. Setiawan, B. et al. 2017. Measurement of 3-axis magnetic fields induced by current wires using a smartphone in magnetostatics experiments. *Physics Education*. 52, 6 (2017), 065011.
38. Sumantri, M.S. et al. 2022. Maker-Centered Project-Based Learning: The Effort to Improve Skills of Graphic Design and Student's Learning Liveliness. *Journal of Educational and Social Research*. 12, 3 (2022), 191–191. DOI:<https://doi.org/10.36941/jesr-2022-0078>.
39. Sumilat, J.M. et al. 2022. The Utilization of Online Media in Calculation Operations Mathematics Learning in Elementary School Students. *Journal of Educational and Social Research*. 12, 3 (2022), 90–90. DOI:<https://doi.org/10.36941/jesr-2022-0069>.
40. Syawaludin, A. and Rintayati, P. 2019. Development of Augmented Reality-Based Interactive Multimedia to Improve Critical Thinking Skills in Science Learning. *International Journal of Instruction*. 12, 4 (2019), 331–344.
41. Thees, M. et al. 2020. Effects of augmented reality on learning and cognitive load in university physics laboratory courses. *Computers in Human Behavior*. 108, (2020), 106316.
42. Toledo-Morales, P. and Sanchez-Garcia, J.M. 2018. Use of augmented reality in social sciences as educational resource. *Turkish Online Journal of Distance Education*. 19, 3 (2018), 38–52.

43. Trifena Tarusu, D. et al. 2022. Student character establishment in mathematics learning in elementary school during coronavirus pandemic. *Cypriot Journal of Educational Sciences*. 17, 8 (Aug. 2022), 2811–2822. DOI:<https://doi.org/10.18844/cjes.v17i8.7783>.
44. Weiss, D. et al. 2022. Effects of Using Artificial Intelligence on Interpersonal Perceptions of Job Applicants. *Cyberpsychology, Behavior, and Social Networking*. 25, 3 (2022), 163–168.
45. Wong, K.M. and Samudra, P.G. 2021. L2 vocabulary learning from educational media: Extending dual-coding theory to dual-language learners. *Computer Assisted Language Learning*. 34, 8 (2021), 1182–1204.
46. Zhang, Z. et al. 2021. An augmented reality-based multimedia environment for experimental education. *Multimedia Tools and Applications*. 80, 1 (2021), 575–590.
47. Zheng, W. et al. 2019. An empirical study of incorporation of augmented reality into civic education. (2019), 30–34.
48. Zulela, M. et al. 2022. How is the Education Character Implemented? The Case Study in Indonesian Elementary School. *Journal of Educational and Social Research*. 12, 1 (2022), 371–371.
49. Zulfarina, Z. et al. 2021. E-Magazine Based on Augmented Reality Digestive as Digital Learning Media for Learning Interest. *Journal of Education Technology*. 5, 3 (2021).

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