Proceedings of The 2nd International Conference on Science and Islamic Studies
ISSN: 3024-9058 (Online - Elektronik)
Volume: 2, 2024
Publisher: Program Pascasarjana, UIN Alauddin Makassar

THE EFFECT OF PROBLEM BASED LEARNING MODEL ASSISTED BY AUGMENTED REALITY ON PGSD STUDENTS LEARNING OUTCOME AT UNIMEN

Dian Firdiani[1], **Muhammad Yaumi**[2], **Yuspiani**[3], **M. Shabir Usman**[4], **& Andi Citra Pratiwi**[5]

[1,2,3,4]Universitas Islam Negeri Alauddin Makassar, Indonesia
[5]Universitas Negeri Makassar, Indonesia
Correspondence email: dianfirdiani1@gmail.com

ABSTRACT

This study aims to determine the effect of the Problem Based Learning (PBL) model assisted by Augmented Reality (AR) technology on students' learning outcomes in the Basic Concepts of Science course at the Primary School Teacher Education Program (PGSD) of Muhammadiyah University of Enrekang (UNIMEN). The Problem Based Learning model is known for its ability to develop students' critical thinking, problem-solving, and collaboration skills. Meanwhile, Augmented Reality as a learning medium provides a more interactive learning experience and facilitates the understanding of abstract concepts in the Basic Concepts of Science course. The sample in this study consisted of Class A and Class B, selected using purposive sampling techniques. This study employed a quasi-experimental method with a pretest-posttest control group design. Data on students' learning outcomes were collected using test instruments that had been validated for reliability and validity. Data analysis was conducted using statistical tests to compare the learning outcomes between the two groups. The results showed that the average pretest score of the experimental group was 58.07, while the average post-test score was 85.32. In contrast, the control group had an average pretest score of 51.60 and a post-test score of 64.35. Hypothesis testing using the T-Test revealed a p-value < 0.05 at a 5% significance level, indicating a significant difference in the average learning outcomes scores. Thus, it can be concluded that the Problem Based Learning model assisted by Augmented Reality has a positive impact on students' learning outcomes in the Basic Concepts of Science course.

Keywords: Problem based learning; augmented learning; science

Copyright © 2024: the Author(s)

1. INTRODUCTION

Education is one of the main pillars in the development of a nation. In the context of higher education, particularly in the Primary School Teacher Education (PGSD) program, there is a need to equip students with deep conceptual understanding and critical thinking skills. One of the essential courses taught in the PGSD program is the Basic Science Concepts course. This course is designed to provide prospective teachers with a strong scientific foundation, enabling them to teach science effectively at the elementary school level.

However, various studies have shown that mastering science concepts often poses challenges for students, especially when it comes to understanding abstract concepts that require effective visualization. In the digital era, technological advancements have opened up significant opportunities to address these challenges. One innovation in learning is the use of Augmented Reality (AR) technology. Augmented reality is a technology that integrates virtual and real worlds by projecting virtual objects as 3D models in real time through a camera (Wahid et al., 2017). As stated by Ramadani et al. (2020), augmented reality is a method that can be used to visualize images in three-dimensional forms using technology.

In addition to utilizing AR technology, the Problem Based Learning (PBL) model is also known to be effective in developing critical thinking skills and problem solving abilities among students. This PBL model emphasizes students' ability to solve problems using visual media, such as sequencing images, displaying images, providing descriptions for images, or describing them. This approach leverages current issues as the context for learning to train critical thinking, develop problem-solving strategies, and gain key knowledge and ideas related to the subject matter being studied (Kurniawati, 2020). This learning model is designed to help students acquire deeper knowledge than before, enabling them to become adept at solving problems, developing learning strategies tailored to themselves, and enhancing collaboration skills within groups (Reza et al., 2019).

The integration of AR technology into the Problem Based Learning (PBL) model offers significant potential to enhance student learning outcomes, especially in courses requiring complex visualization, such as Basic Science Concepts. Through AR, students can visualize scientific processes, natural phenomena, or structures that are difficult to comprehend through text or two-dimensional images alone. In PBL-based learning, this technology can support students in analyzing problems, designing solutions, and presenting their findings in more creative and interactive ways.

However, despite the significant potential of AR technology and the PBL model, their application in education, particularly in the PGSD program, remains relatively new and rarely a focus of research. Many lecturers still rely on conventional teaching methods, such as lectures or one-way classroom discussions. These methods are often less effective in improving student learning outcomes because they do not provide enough opportunities for active student engagement in the learning process. Additionally, many lecturers perceive AR media as difficult to implement. This aligns with Wandah's (2017) observation that many educators in the field are unable to optimize technology to create learning experiences involving technology-based media, such as computers. Most educators face technical challenges in developing electronic learning media, particularly in mastering programming techniques and improving visual or design aspects.

Based on the explanation above, the author aims to examine the impact of the Problem-Based Learning model assisted by augmented reality on the learning outcomes of Basic Science Concepts for PGSD students at UNIMEN.

2. METHODS

This research is a pre-experimental type, a kind of quasi-experimental design that is not considered a true experiment. This occurs because the dependent variable is still influenced by external factors. The design used in this study is a one-group pretest-posttest design. Both the control and experimental groups took a pretest before the treatment to assess their initial abilities, followed by a posttest after the treatment to evaluate their learning outcomes.

This study was conducted in the Primary School Teacher Education Program at Muhammadiyah University of Enrekang. The population for this study consisted of 1st semester of PGSD students at the 2024/2025 academic year, divided into three classes: A, B, and C. The sample for this research consisted of students from classes A and B, selected using purposive sampling technique.

The instrument used in this research was a multiple-choice test on the Basic Science Concepts learning outcomes. The data analysis techniques employed in this study were descriptive statistics and inferential statistics, including hypothesis testing using the T-Test and normality testing with N-Gain.

3. RESULTS AND DISCUSSION

Based on the research findings and statistical analysis, the learning outcomes of Basic Science Concepts for PGSD UNIMEN students taught using the Problem Based Learning model assisted by Augmented Reality are as follows:

Table 1. Learning Outcomes of Basic Science Concepts for Experimental Class

Statistic	Learning Outcomes	
	Pretest	Posttest
Highest Score	85	100
Lowest Score	35	85
Average	58.07	85.32

Based on the table above, it can be observed that the highest score in the pretest was 85, while the score in the posttest was 100. This indicates a significant improvement between the pretest and posttest. The lowest score in the pretest was 35, while the score in the posttest was 87, also showing a significant increase. Furthermore, in the experimental class, the average score for students' learning outcomes in the pretest was 58.07, while in the posttest phase, it was 85.32. This demonstrates that the Problem Based Learning model was effective in improving students' learning outcomes.

Meanwhile, in the control class, which was taught using the direct teaching model commonly used by lecturers, the following results were obtained:

Table 2. Learning Outcomes of Basic Science Concepts for Control Class

Statistic	Learning Outcomes	
	Pretest	Posttest
Highest Score	70	85
Lowest Score	25	55
Average	51.60	64.35

Based on the table above, it shows that the highest score in the pretest was 70, while the highest score in the posttest was 85, indicating a slight difference between the two highest scores. The lowest score in the pretest was 25, while the lowest score in the posttest was 55. Additionally, the average learning outcomes for students in the control class were 51.60 in the pretest, which increased to 64.35 in the posttest.

Normality and homogeneity tests were conducted using the Shapiro-Wilk test. The results showed that the p-values for the pretest in both the experimental and control classes indicated normally distributed data ($p > 0.05$). Similarly, the posttest results for both classes also showed normally distributed data ($p > 0.05$). A hypothesis test was then carried out using a T-Test, and the research conclusion was deemed significant because the p-value was < 0.05, with a 5% significance level.

Based on this analysis, it can be concluded that after applying the Problem Based Learning model assisted by Augmented Reality in the experimental class and the direct teaching model in the control class, there was a difference in the average learning outcome scores between the two classes. Therefore, it can be inferred that there was a significant improvement in the learning outcome scores of the experimental class after implementing the Problem Based Learning model assisted by Augmented Reality compared to the control class, which used the direct teaching model.

The increase in the average pretest-posttest scores was analyzed using the N-Gain formula to assess the improvement in students' learning outcomes as follows:

Table 3. N-Gain Test Results for the Control Class and Experimental Class.

Class	**Gain**	**N-Gain**
Experiment	35,53	0,83
Control	28,67	0,41

Based on the gain analysis, the results showed that the improvement from applying the Problem Based Learning model assisted by Augmented Reality reached 83%, which falls into the

high category. In contrast, the control class, which implemented the direct teaching model, achieved a gain of 41%, categorized as moderate.

Based on the hypothesis test using the T-Test, the result $P<\alpha$ indicates that H_0 is rejected, meaning that the application of the Problem Based Learning model assisted by Augmented Reality effectively improves the learning outcomes of Basic Science Concepts for PGSD UNIMEN students. The use of the Problem Based Learning model supported by Augmented Reality media enhances learning outcomes in the cognitive domain and promotes student independence. This model emphasizes student-centered learning, leveraging accessible technology to create active and innovative learning processes. It also develops critical thinking, communication, collaboration, and creativity skills, supporting the achievement of learning objectives (Wulan, 2022). Furthermore, in this learning approach, students are encouraged to solve contextual problems relevant to everyday life through group activities. This method hones students' critical thinking skills, making the learning process more meaningful (Madiun, 2020). The effectiveness of implementing the Problem-Based Learning model assisted by Augmented Reality to improve learning outcomes and student independence aligns with Wayan's (2023) findings. Wayan stated that the use of this model enhances both learning outcomes and students' independence in learning. Based on the research findings and supported by relevant studies, it can be concluded that the implementation of the Problem Based Learning model assisted by Augmented Reality effectively improves the learning outcomes of Basic Science Concepts for PGSD UNIMEN students in the first semester of the 2024/2025 academic year.

4. CONCLUSION

Based on the data analysis and discussion, it can be concluded that the application of the Problem Based Learning model assisted by Augmented Reality effectively improves the learning outcomes of Basic Science Concepts for PGSD UNIMEN students in the first semester of the 2024/2025 academic year. This is evident from the experimental class's average pretest score of 58.07, which increased to 85.32 in the posttest. The learning outcomes in the experimental class achieved an average N-Gain of 0.83, categorized as high, while the control class achieved an average N-Gain of 0.41, categorized as low. Based on these findings, it can be concluded that the average N-Gain of the experimental class is significantly higher than that of the control class.

Acknowledgment

The author would like to express heartfelt gratitude to the Head of the Primary School Teacher Education Program at Universitas Muhammadiyah Enrekang (UNIMEN) and to fellow lecturers at UNIMEN for their support and the opportunity to conduct this research.

Authors' contribution

Dian Firdiani: Designed the research, conducted data analysis, and drafted the main manuscript. Muhammad Yaumi: Provided conceptual input on the research methodology. Yuspiani: Offered critical feedback on the research findings. M. Shabir Usman: Provided critical feedback on the research findings. Andi Citra Pratiwi: Provided to conducted data analysis.

REFERENCES

Aenun N., Andi F., & Hasmaraeni. (2023). Peningkatan Hasil Belajar IPA Siswa Kelas I SMP dengan Model Project Based Learning (PJBL) di SMP Negeri 1 Suli. *Jurnal Pemikiran dan Pengembangan Pembelajaran*, 5 (2), 286-291.

Agung. (2014). *Metodologi Penelitian Pendidikan*. Aditya Media Publishing: Malang.

Anjelina Putri, A. A., Swatra, I. W., & Tegeh, I. M. (2018). Pengaruh Model Pembelajaran Pbl Berbantuan Media Gambar Terhadap Hasil Belajar IPA Siswa Kelas III SD. *Mimbar Ilmu*, *23* (1), 53–64.

Dewi, P.R.P.I., Wijayanti, N.M.W., dan Juwana, I.D.P. (2022). Efektivitas Penerapan Media Pembelajaran Digital Assemblr Edu Pada Mata Pelajaran Matematika Di SMK Negeri 4 Denpasar. *Jurnal Pengabdian Kepada Masyarakat Widya Mahadi*, *2*(2), 98–109.

Hendriana, B., Nuriadin, I., & Rachmaeni, L. (2019). Pengaruh Model Brain-Based Learning Berbantuan *Augmented reality* Terhadap Kemampuan Spasial Matematis Siswa (The Influence of Brain-Based Learning Model with *Augmented reality* O_n_ _S_t_u_d_e_n_t_'s Ability of Spatial Mathematics). *Jurnal THEOREMS (The Original Research of Mathematics)*, *4*(1), 18–28.

Kurniawati, Evi. (2020). *Efektivitas Model Problem Based Learning Terhadap Kemampuan Berpikir Spasial Siswa Mata Pelajaran Geografi Kelas XI IPS SMA Negeri 10 Malang*. Repository Universitas Negeri Malang.

Madiun, U. P. (2020). Pengaruh Penggunaan Model Pembelajaran PBL terhadap Keterampilan HOTS Siswa SD. *Jurnal Prosiding Konferensi Ilmiah Dasar*. Volume, 2(1), 277–285.

Ramadani, R., Ramlawati, R., & Arsyad, M. (2020). Pengembangan Modul Pembelajaran Kimia Berbasis Augmented Reality. *Chemistry Education Review (CER)*, 3(2), 152.

Sugiarto, A. (2022). Penggunaan Media Augmented Reality Assemblr Edu untuk Meningkatkan Pemahaman Konsep Peredaran Darah. *Madaris: Jurnal Guru Inovatif*, 1 (2), 1-13.

Syafitri, R., Suzana, Y., & Risdianto, H. (2018). Pengaruh Software *Augmented Reality* pada Siswa Bergaya Visual di SMP Negeri 8 Langsa. *Jurnal Pendidikan Matematika*, *1*(2), 30–36.

Wahid, A., Anra, H., & Tursina. (2017). Cross Platform Aplikasi Augmented Reality untuk Mata Pelajaran Kimia Struktur Molekul. *Jurnal Sistem Dan Teknologi Informasi (JUSTIN*), 5(3), 201–205.

Wayan Ekayogi. (2023). Penerapan Problembasedlearningberbantuan Media Augmentedrealityuntuk Meningkatkan Hasildan Kemandirian Belajar. *Jurnal Didaktika Pendidikan Dasar*. 7 (1), 181-196.

Wulan, D. C. (2022). *Penerapan Model Pembelajaran PBLBerbantuan Video*. April, 1337–1343.