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The Impact of Using Problem-Based Learning (PBL) with Augmented Reality Flashcard on Elementary School Student's Scientific Literacy and Problem Solving Skill in Solar System

Dian Fasihah[1], Sudarti[2], Trapsilo Prihandono[3]
[1,2,3] Universitas Jember, Indonesia

ABSTRACT: This study aims to examine the effect of the Problem Based Learning (PBL) model integrated with Augmented Reality (AR)-based flashcard media on the scientific literacy and problem-solving skills of elementary school students regarding the solar system. This quantitative research involved sixth-grade students at SDN Dabasah 3 Bondowoso, divided into an experimental class using PBL and AR flashcards and a control class using conventional methods. Data were collected through observations and essay tests. The results indicate a significant influence of the PBL model with AR flashcard media on both scientific literacy and problem-solving skills. This is evidenced by the $t_{hitung} > t_{tabel}$ values for both variables (3.764 > 2.026 for scientific literacy and 3.064 > 2.026 for problem-solving). Furthermore, the average problem-solving score for the experimental group is 82 was higher than that of the control group is 71.6. In conclusion, the integration of AR technology within the PBL model is effective in increasing student engagement, visualizing abstract concepts, and optimizing cognitive skills in elementary education.

KEYWORDS: Augmented Reality, IPAS, Literasi Sains, Kemampuan Memecahkan Masalah, Problem-Based Learning.

INTRODUCTION

Education today is witnessing a major shift where simply mastering content is no longer enough. Our primary focus is now on how to build strong scientific literacy in children starting from elementary school. Scientific literacy is not just about memorizing formulas or the names of planets, but about how students can use scientific logic to understand the phenomena around them and make evidence-based decisions (OECD, 2019). However, the reality on the ground is often different; scientific literacy remains a significant "homework" because the learning process is still frequently stuck in one-way lecture methods.

This issue then spills over into low problem-solving abilities. In fact, in the future, children are required to have sharp critical and analytical thinking skills to face increasingly complex problems.. If in school they are only accustomed to receiving information without ever being trained to find solutions, then their cognitive potential will not develop to its maximum. This creates a gap between what they learn in class and the reality of life they actually live every day.

This gap is most evident in abstract subjects, such as the Solar System. Imagine children being asked to understand the movements of planets, which are unimaginably vast, only through static images in textbooks or oral explanations. It is no wonder many students feel bored and find it difficult to visualize the concept fully. This limited visualization becomes a major obstacle that makes science feel distant and out of reach for their imagination (Sudarti, 2019).

In a more specific context, the effectiveness of this learning process heavily relies on media capable of fully stimulating scientific literacy indicators. Through AR flashcards, students are not only encouraged to explain phenomena scientifically regarding planetary motion but are also challenged to evaluate and design scientific inquiry through interactive virtual exploration. This technology transforms abstract data into visuals, making it easier for students to interpret scientific data and facts without feeling burdened by rigid theories (PISA, 2025)

AR flashcard media compels students to begin the process of exploring and understanding contextual problems before them, which then moves to the stage of representing and formulating solutions creatively. Within the PBL cycle, students do not just plan and execute problem-solving actions; they are also invited to monitor and reflect on the outcomes they achieve. In line with the views of Saidin, Halim, and Yahya (2020), this AR-based media goes beyond being a mere teaching aid; it is a bridge

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that makes learning more interactive and meaningful, as every real-time interaction directly trains the students' cognitive skills and scientific attitudes simultaneously (OECD, 2023).

To break this deadlock, we need to change how we teach. The Problem Based Learning (PBL) model offers a more humanized approach, where students are invited to become "young researchers" seeking answers to a problem. However, PBL alone might not be enough if it is not supported by relevant tools. This is where Augmented Reality (AR) technology through flashcard media becomes crucial. With AR, planets that were once just dots in a book can appear in 3D and interactively before them, making abstract concepts much more concrete and real.

Learning effectiveness never stands alone; it depends not only on the right choice of model but also on the urgency of using supporting media that can capture students' imagination. This study integrates the Problem Based Learning (PBL) model with Augmented Reality (AR)-based flashcards to create a new learning ecosystem. These flashcards are more than just ordinary cards; they are a medium evolved with QR Code technology to bring the solar system theme to life in the classroom. Designed with a 'learning through play' philosophy, this media is contextual and collaborative, aiming beyond mere cognition—it seeks to foster both understanding and environmental awareness. In line with Saidin, Halim, and Yahya (2020), the use of AR is not just a trend but an effective way to engage students, make the atmosphere more interactive, and create meaningful learning through real-time interaction between users and virtual applications.

METHOD RESEARCH

This study is designed to find answers to modern educational challenges through a quantitative approach with a Quasi-Experimental design in the form of a Control Group Post-test Only. The chosen location is SD Negeri Dabasah 3 Bondowoso, a space where this innovation was tested. The research subjects included all sixth-grade students, who were then strategically grouped into two: Class 5A as the experimental group, experiencing active learning through the PBL model and AR flashcard media, and Class 5B as the control group, which continued using conventional lecture and question-and-answer methods. The measured scientific literacy indicators focus on the students' ability to explain phenomena scientifically, evaluate and design scientific inquiry, and interpret scientific data and facts. This is conducted to see how AR visualization helps students process previously abstract information into tangible knowledge.

Simultaneously, this study also dissects students' problem-solving skills through four crucial stages: exploring and understanding the problem context, representing and formulating solutions, planning and executing actions, and finally, the ability to monitor and reflect on the achieved results. The use of the PBL model with AR flashcards is expected to trigger each of these indicators naturally. Finally, all collected data were objectively processed using SPSS software, starting with normality tests as a prerequisite, before drawing conclusions through the Independent Sample T-test hypothesis test.

RESULTS

This research aims to examine the effect of implementing the Problem-Based Learning (PBL) model combined with AR-based flashcards on students' scientific literacy and problem-solving skills. Data collection was conducted through the posttest scores of the experimental and control groups. The experimental group received the treatment, where learning was delivered using the PBL model combined with AR flashcards. In contrast, the control group followed a conventional learning model using only lectures and Q&A sessions. Based on the data, a significant difference was found between the two groups, with the experimental group achieving a higher average score than the control group. The comparison between the control and experimental groups is as follows:

Tabel 1 Comparison of Scores between Control and Experimental Groups

Statistical data	*Posttest*			
	Literasi Sains		Kemampuan Memecahkan Masalah	
	Highest Score	Lowest Score	Highest Score	Lowest Score
Control Groups	89	45	92	50
Experimental Groups	100	56	100	58
Mean	Control Groups : 67,5		Control Groups: 71,6	

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Statistical data	*Posttest*			
	Literasi Sains		Kemampuan Memecahkan Masalah	
	Highest Score	Lowest Score	Highest Score	Lowest Score
	Experimental Groups: 81,5		Experimental Groups: 82	

Based on Table 1, in the scientific literacy variable, the experimental class (81.5) showed a significant difference compared to the control class (67.5); furthermore, there were also differences in the highest and lowest scores between the experimental and control classes. Meanwhile, in the problem-solving skills variable, the experimental class obtained a higher average compared to the control class, with a mean score of 82 for the experimental class and 71.6 for the control class

1. Analysis of the Influence of the Problem-Based Learning (PBL) Model with AR-based Flashcard Media on Scientific Literacy in the Solar System Topic.

This analysis was conducted using a normality test, followed by an independent sample t-test. The test utilized the Shapiro-Wilk method because the sample size was less than 30. Data are considered normal if the significance value is > 0.05.

Tabel 2 Results of the Scientific Literacy Normality Test

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Kelompok	Statistic	df	Sig.	Statistic	df	Sig.
Hasil	Kelompok Eksperimen	.217	20	.014	.923	20	.116
	Kelompok Kontrol	.215	19	.021	.917	19	.098

a. Lilliefors Significance Correction

Based on the results of the Shapiro-Wilk normality test, both groups—the experimental class with a significance value of 0.116 and the control class with a significance value of 0.098—are declared to be normally distributed.

The independent samples t-test aims to determine the difference in means between two unpaired sample groups, namely the experimental class and the control class. The t-test is conducted only if the class groups are normally distributed. The results of the independent samples t-test for scientific literacy are presented below

Table 3: Results of the Independent Samples T-test for Scientific Literacy

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Hasil	Equal variances assumed	.176	.677	3.764	37	.001	13.97368	3.71284	6.45075	21.49661
	Equal variances not assumed			3.763	36.873	.001	13.97368	3.71343	6.44868	21.49869

Based on the SPSS calculation results above, it was found that for df 37 with a significance level of 0.05, the t-table value is 2.026. Since the t-value (3.764) is greater than the t-table (2.026), it can be concluded that H0 is rejected and Ha is accepted. This indicates that there is a significant influence of the PBL learning model combined with AR-based flashcards on the scientific literacy of elementary school students regarding the solar system material. This finding is further supported by the mean scientific literacy score of the experimental group (81.5), which is higher than that of the control group (67.5). These results demonstrate that the implementation of this treatment has a significant positive impact on improving students' scientific literacy skills.

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2. Analysis of the Influence of the Problem-Based Learning (PBL) Model with AR-based Flashcard Media on Problem-Solving Skills in the Solar System Topic.

A normality test was conducted to determine whether the posttest data from the control and experimental classes were normally distributed; this ensures the statistical validity of the hypothesis testing results. The initial step involved testing whether the data were normally distributed, followed by an independent samples t-test, as shown in the following table.

Table 4: Results of the Problem-Solving Skills Normality Test

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Kelompok	Statistic	df	Sig.	Statistic	df	Sig.
Hasil	Kelompok Eksperimen	.228	20	.008	.936	20	.204
	Kelompok Kontrol	.187	19	.079	.929	19	.168

a. Lilliefors Significance Correction

The results of the Shapiro-Wilk normality test indicate that the learning outcome data for both groups are normally distributed. Both classes are declared normally distributed as they have a significance value > 0.05. The control class obtained a significance value of 0.168, while the experimental class obtained a significance value of 0.204. Based on these data, the analysis can proceed with the independent samples t-test, as follows:

Table 4.10: Results of the Problem-Solving Skills Normality Test

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Hasil	Equal variances assumed	.078	.782	3.064	37	.004	10.40263	3.39509	3.52353	17.28174
	Equal variances not assumed			3.059	36.519	.004	10.40263	3.40065	3.50919	17.29608

An independent samples t-test was conducted to analyze the difference in the mean problem-solving scores between the control and experimental classes. The results showed that for df 37 at a significance level of 0.05, the t-table value is 2.026. Since the t-value (3.064) is greater than the t-table (2.026), it can be concluded that H0 is rejected and Ha is accepted. This indicates a significant influence of the PBL model combined with AR-based flashcards on the problem-solving skills of elementary school students regarding the solar system material. This finding is further supported by the mean problem-solving score of the experimental group (82), which is higher than that of the control group (71.6)

DISCUSSION

Based on the hypothesis testing results, the implementation of the PBL model with AR flashcards significantly enhances and outperforms the control class in improving both scientific literacy and problem-solving skills. The superiority of the experimental class is driven by the following factors:

- AR Flashcard Media serves as a tool that motivates and facilitates students during teaching and learning activities. This was evidenced by the students' high interest and enthusiasm when using the flashcards. AR flashcards support students in representing abstract concepts as concrete objects, leading to a better understanding of the material. This aligns with research by Amanullah (2020), which states that AR technology is capable of visualizing scientific concepts.
- The implementation of the PBL model enhances student engagement, enabling them to actively explain scientific concepts and draw conclusions regarding the problems presented by the teacher. The PBL model effectively integrates

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digital learning media, significantly improves higher-order thinking skills, and encourages students to be proactive in discovering their own knowledge.

CONCLUSION

The implementation of the PBL model for sixth-grade students at SD Negeri Dabasah 3 Bondowoso demonstrates that the PBL model paired with AR flashcards has a significant impact on scientific literacy and problem-solving skills in the solar system topic. This indicates that applying PBL with technology-integrated learning media increases student activity and fosters a deep conceptual understanding. Furthermore, the PBL model proves to strengthen student-centered learning orientations, particularly in enhancing literacy and problem-solving capabilities

REFERENCES

1. Agustina, T., dan E. Setiawan. 2020. Upaya Meningkatkan Kemampuan Pemecahan Masalah pada Anak Usia 5-6 Tahun melalui Kegiatan Sentra Balok. Jurnal Pendidikan Anak. 4(2): 337-351.
2. Asnawati, S., Sutrisno, dan Imaningtyas. 2021. Pengembangan E-Student Worksheets Berbasis Literasi Sains dalam Pembelajaran IPA Muatan Gaya untuk Siswa Kelas IV Sekolah Dasar. Efektor. 8(2): 98-109.
3. Bektiarso, S. (2024). The effect of the principal's transformational leadership and school organisational culture on the performance of junior high school teachers with work ethic as a moderating variable. International Journal of Management in Education, 18(6), 595-614.
4. Bektiarso, S., & Dewi, D. R. (2021, March). Effect of Problem based learning models with 3D thinking maps on creative thinking abilities and physics learning outcomes in high school. In Journal of Physics: Conference Series 1832 (1). IOP Publishing.
5. Hermansyah. 2020. Problem Based Learning in Indonesian Learning. Universitas Sebelas Maret. 3(3): 2257-2262.
6. Kurniawan, Y. I., dan A. F. S. Kusuma. 2019. Aplikasi Augmented Reality untuk Pembelajaran Salat Bagi Siswa Sekolah Dasar. Jurnal Teknologi Informasi dan Ilmu Komputer. 8(1): 7-14.
7. Latifa, A., Z., dkk. 2024. Implementasi Model PBL untuk Meningkatkan Aktivitas Belajar Matematika SD Gisikdrono 02 Semarang. Jurnal Inovasi Penelitian. 4(8): 1345-1354.
8. Mulianti, S. A. 2023. Penagruh Pendekatan Problem Based Learning Berbantuan Augmented Reality Terhadap Kemampuan Pemahaman Konsep dan Pemecahan Masalah Matematika di SMK Negeri 1 Lembong. Tesis. Bengkulu: Universitas Bengkulu.
9. Usmaedi, U., Fatmawati, dan Karisman. 2020. Pengembangan Media Pembelajaran Berbasis Teknologi Aplikasi Augmented Reality dalam Meningkatkan Proses Pengajaran Siswa Sekolah Dasar. Jurnal Educatio FKIP UNMA. 6(2): 489-499.

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