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Implementation of Anticipation Guides Reading Strategy Integrated with Generative AI (Gen-AI) to Improve Mathematical Literacy of PGSD Students

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ABSTRACT

This study examines how implementing the Anticipation Guides reading strategy, integrated with Generative AI (GenAI) technology, affects the mathematical literacy skills of Elementary School Teacher Education (PGSD) students. The research uses a quasi-experimental design with a pretest-posttest control group, involving two groups: the experimental group using the integrated strategy and the control group using alternative teaching methods. The sample consists of 50 PGSD students, with 25 in each group. Data were collected through a mathematics literacy test. The results indicate that the Anticipation Guides reading strategy, when integrated with Generative AI (GenAI), significantly influences the mathematical literacy skills of PGSD students, as evidenced by a significance value (sig) < 0.05. This research contributes significantly to the development of knowledge in education, particularly by enhancing the effectiveness of mathematics instruction through innovative technologies that enrich students' learning experiences and deepen their understanding of mathematical concepts.

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1. INTRODUCTION

Mathematical literacy refers to the ability to use, understand, and communicate mathematical concepts in everyday contexts. However, international evaluations, such as PISA, indicate that Indonesia continues to face significant challenges in mathematical literacy. In 2018, Indonesia scored only 379, well below the OECD average of 489, placing the country 74th among 79 participating nations (OECD, 2023). This performance indicates that students in the Elementary School Teacher Education (PGSD) program must possess strong mathematical literacy skills, given their role as prospective elementary-level educators. However, many PGSD students still lack sufficient mathematical literacy, which can affect the quality of teaching they provide in elementary schools (Susanta et al., 2023). This observation aligns with the researcher's own observations regarding the mathematical literacy skills of PGSD students.

One way to improve mathematical literacy is to use effective reading strategies. In this context, the Anticipation Guide has proven beneficial. This strategy presents statements about the material to be studied before reading and then reevaluates students' understanding after the lesson. Woolfolk (Antoni et al., 2017) describes an Anticipation Guide as a series of questions or statements related to the topic or point of view in a particular text. This method can help teachers activate students' prior knowledge and make sound decisions about how to improve students' comprehension of the reading text. This approach not only enhances text comprehension but also increases student engagement in the learning process (Evans et al., 2022). Research also shows that implementing an Anticipation Guide can improve students' learning outcomes and reading comprehension, thereby enhancing their mathematical literacy (Sari & Sari, 2019). Additionally, technological advancements, particularly Generative AI (GenAI), offer significant opportunities to create more personalized and adaptive learning experiences. GenAI has the potential to generate learning materials tailored to students' individual needs, provide real-time feedback, and offer more interactive and engaging explanations (Robert et al., 2023). Thus, integrating GenAI into mathematics education can help PGSD students understand complex concepts more effectively and increase their engagement in the learning process (OECD, 2023).

The importance of innovation in education, particularly in the PGSD program, has become increasingly evident as the demand grows to prepare future teachers who not only master the subject matter but also possess the skills to use technology effectively in the learning process. Therefore, implementing the Anticipation Guide strategy, integrated with GenAI, could be an innovative solution to help PGSD students enhance their mathematical literacy and strengthen their ability to use technology to support the learning process (Susanta et al., 2023).

This study aims to analyze the impact of integrating the Anticipation Guide reading strategy with GenAI on PGSD students' mathematical literacy skills. The significance of this research lies in its contribution to developing more effective and adaptive teaching methods and in providing new insights that can enrich the teaching process at the higher education level, particularly in teacher education (Susanta et al., 2023).

Literacy helps students comprehend oral, written, audio, and visual texts. Mathematical literacy refers to the mathematical skills required to solve problems encountered in everyday life (Börner, 2019; Ekawati, 2020; Holenstein, 2021; Machaba, 2018; Novita, 2021). Mathematical literacy is a crucial skill that every individual must possess in modern life. Mathematical literacy is defined as the ability to formulate, apply, and interpret mathematics

in various everyday contexts. It involves the use of mathematical concepts, procedures, facts, and tools to explain and predict phenomena in the world around us, thereby enabling informed decision-making, problem-solving, and critical thinking (Leton et al., 2020). Therefore, mathematical literacy goes beyond merely applying algorithms or memorizing formulas; it encompasses reasoning, communicating mathematical ideas, and connecting mathematics to everyday life and other disciplines.

For students in the Elementary School Teacher Education (PGSD) program, mathematical literacy is vital. They are not only required to master mathematical concepts but also to teach them to their future elementary school students. The mathematical knowledge of PGSD students will significantly impact their professional development and their future teaching of mathematics (Leton et al., 2020). Research shows that teachers with strong mathematical literacy are better able to foster a mathematical mindset in their students, which, in turn, improves students' learning outcomes and boosts their confidence in using mathematics (Genc & Erbas, 2020).

However, developing mathematical literacy among prospective elementary school teachers faces numerous challenges. One of the main barriers is a lack of preparation to teach mathematical concepts effectively. Many prospective teachers find it difficult to teach mathematics because they do not fully understand the concepts they are supposed to teach their students. Genc & Erbas (2020) note that although teachers receive training to enhance their mathematical literacy, they often revert to familiar traditional methods and struggle to apply newer, more innovative approaches that align with contemporary educational needs.

One method that can support the development of mathematical literacy is the Anticipation Guide reading strategy. This strategy involves presenting statements or questions related to the material to be studied before reading, and then reevaluating students' understanding after the lesson to assess changes in comprehension. The Anticipation Guide stimulates students' initial thinking, making them better prepared to engage with the material and enhancing their involvement in the learning process. Research by Sari & Sari (2019) shows that implementing the Anticipation Guide can improve students' reading comprehension, thereby enhancing their understanding of mathematical concepts. By applying this strategy, PGSD students can more easily relate mathematical concepts to their prior knowledge and recognize the relevance of mathematics in their everyday lives.

In addition, technology has significant potential to support mathematics learning, particularly through the integration of Generative AI (GenAI). GenAI can provide deeper explanations of the material being studied, offer real-time feedback, and present alternative methods for solving mathematical problems that may be difficult for students to understand. According to Robert et al. (2023), GenAI can be used to provide additional explanations, create more adaptive learning materials, and offer real-time feedback that allows students to improve their understanding. GenAI offers a more personalized and adaptive approach, enabling students to learn in ways that match their individual needs and levels of understanding. The OECD (2023) notes that the use of technology in education, particularly in mathematics instruction, can enrich students' learning experiences and enhance their understanding of complex concepts.

By integrating Anticipation Guide and GenAI, mathematics education for prospective teachers can be more effective. The Anticipation Guide strategy helps students formulate predictions and expectations about the material to be studied, while GenAI provides deeper explanations

and feedback tailored to their understanding level. Thus, these two approaches can complement one another, enhancing PGSD students' mathematical literacy and preparing them to teach mathematics more effectively and engagingly. In developing mathematical literacy, prospective teachers need to have a strong understanding of mathematical concepts and the skills to teach them innovatively and enjoyably. Therefore, based on the explanation above, the hypothesis of this study is: "The reading strategy of Anticipation Guides integrated with GenAI has an impact on the mathematical literacy skills of PGSD students." With instruction grounded in this approach, it is hoped that prospective teachers will be better prepared to teach mathematics in a more adaptive, interactive, and relevant way to meet the needs of their future students.

2. METHODS

This study employed a quantitative experimental design to examine the effect of integrating the Anticipation Guides reading strategy with Generative AI (GenAI) on the mathematical literacy skills of Elementary School Teacher Education (PGSD) students. The research was conducted at Institut Pendidikan Indonesia Garut and involved 50 PGSD students, who were divided into two groups: 25 in the experimental class and 25 in the control class. The experimental group received instruction using the Anticipation Guide strategy integrated with GenAI in mathematics learning. In contrast, the control group participated in mathematics learning without the treatment applied to the experimental class, such as discussion, and the implementation of a problem-based learning strategy.

Data were collected using a mathematical literacy test comprising questions assessing conceptual understanding and the application of mathematics in everyday contexts. Prior to treatment, both groups were administered a pretest to assess their initial level of mathematical literacy. After the five-week intervention, a posttest was administered to assess improvements in mathematical literacy skills. Data were analyzed using a t-test to assess significant differences between the experimental and control groups and to evaluate the effect of the applied learning strategy on the mathematical literacy of PGSD students.

3. RESULTS AND DISCUSSION

The results of this study consisted of pretest and posttest administered as algebra questions, specifically focusing on systems of linear equations. The purpose of this study was to determine the effect of the treatment on students' mathematical literacy skills. The pretest and posttest scores of the experimental and control classes are presented below.

Table 1. Control and Experimental Class Pretest Scores

Control	Experiment
48	41
41	59
48	44
52	33
48	48
52	56
56	44
56	48
52	37

Control	Experiment
48	48
52	44
44	37
48	52
48	48
56	37
44	44
56	41
59	56
44	41
56	41
48	48
52	56
59	52
56	56
44	63
Min: 41	33
Max: 59	63
Average: 51	47

Based on Table 1, a comparison of pretest scores between the experimental and control classes is shown. In the control class of 25 students, the average score was 51, with a minimum of 41 and a maximum of 59. Meanwhile, in the experimental class, which also consisted of 25 students, the average score was slightly lower than that of the control class, at 47, with a minimum of 33 and a maximum of 63.

Table 2. Control and Experimental Class Posttest Scores

Control	Eksperiment
70	78
65	85
68	83
65	78
68	83
65	80
73	70
70	75
70	78
58	78
65	83
65	80
70	78
68	83
73	80
65	83
68	85

Control	Eksperiment
70	78
68	85
73	88
60	85
70	83
75	83
68	78
73	80
Min: 58	70
Max: 75	88
Average: 68	81

After the treatment was administered to each class, the posttest results in Table 2 indicate that the control class achieved an average score of 68, with a minimum of 58 and a maximum of 75. Meanwhile, the experimental class obtained a higher average score of 81, with a minimum score of 70 and a maximum score of 88. Based on these results, further testing was conducted to examine the effectiveness of the treatment implemented by the researcher.

A normality test was conducted after obtaining the final scores for both the experimental and control classes. The control class was assigned to Class 5B, whereas the experimental class, Class 5A, received the treatment using the Anticipation Guides reading strategy integrated with GenAI.

Table 3. Normality Test Result

Class	Test Type	Sig. (p)	Interpretation
Posttest Eksperimen	Shapiro-Wilk	0.064	Normally distributed (p > 0.05)
Posttest Kontrol	Shapiro-Wilk	0.093	Normally distributed (p > 0.05)

Based on the results of the normality test, the posttest scores for both the experimental and control classes were normally distributed. The calculated p-values indicate that the experimental class (p = 0.064 > 0.05) and the control class (p = 0.093 > 0.05) were statistically significant. Therefore, it can be concluded that both classes are normally distributed since the significance values are greater than 0.05.

After conducting the normality test, the next step was to perform the homogeneity test for the two groups. The homogeneity test was carried out using the SPSS software.

Table 4. Homogeneity Test Result

Class	Test Type	Sig. (p)	Interpretation
Posttest Eksperimen	Levene's Test	0.064	Variations Homogen (p > 0.05)
Posttest Kontrol	Levene's Test	0.093	Varians Homogen(p > 0.05)

Based on the results of the homogeneity test conducted using Levene's test, a significance value of 0.841 was obtained. Since this value is greater than 0.05, it can be concluded that the samples came from the same population, or in other words, were homogeneous.

After the data were confirmed to be normally distributed and to have equal variances (homogeneous), hypothesis testing was carried out using a t-test with the assistance of SPSS software through the Independent Samples T-Test at a significance level of 0.05. The criteria for hypothesis testing were set such that H_o would be rejected if the significance value was

less than 0.05, and H_a would be accepted if the significance value was greater than 0.05. In this study, hypothesis testing was conducted by comparing posttest results between the experimental and control classes. The comparison results are presented in the following table:

Table 5. Hypothesis Test Result

Variable	Test Type	*t*	*df*	*p* (2-tailed)	Interpretation
Mathematical literacy	Independent Sample Test	11.306	48	< 0.001	Significant Effect

Based on the results of hypothesis testing using the Independent Samples T-Test, it was found that the calculated t-value was 11.306 with degrees of freedom (df) = 48, and the significance value (Sig. 2-tailed) was 0.000. Since the significance value is less than 0.05, H_o is rejected, and H_a is accepted. This indicates that the Anticipation Guides reading strategy, when integrated with Generative AI (GenAI), had a significant effect on PGSD students' mathematical literacy skills. The mean difference between the two groups was 12.68 points, with a Standard Error Difference of 1.121. The 95% confidence interval ranged from 10.425 to 14.935, which does not include zero. This further confirms that the effect is statistically significant and not due to chance.

The results of this study demonstrate that the application of the Anticipation Guides reading strategy, integrated with Generative AI (GenAI), had a positive effect on PGSD students' mathematical literacy. The experimental class, which received the treatment, showed a substantially greater increase in mathematical literacy scores than the control class, which received only conventional instruction.

These findings confirm that Anticipation Guides are effective in facilitating students' activation of prior knowledge, building predictions, and directing their focus toward the mathematical concepts being studied. Integration with GenAI further enhances the effectiveness of this strategy by providing real-time feedback, adaptive explanations, and varied practice problems tailored to students' individual needs. The Anticipation Guides strategy is designed to activate prior knowledge, generate predictions, and encourage active student engagement in learning. (Evans et al., 2022) explains that this strategy is effective in improving comprehension because students are encouraged to test and revise their predictions throughout the learning process. The findings of this study support that claim, as students in the experimental class demonstrated significant improvements in mathematical literacy after the implementation of this strategy.

Furthermore, Sari and Sari (2019) also found that Anticipation Guides can enhance reading comprehension and student engagement. In other words, when students are guided to predict and clarify the mathematical concepts under study, they become more active in constructing meaning and more capable of connecting the material to real-life contexts.

The integration of Generative AI (GenAI) strengthens the effectiveness of Anticipation Guides by providing real-time feedback, adaptive explanations, and practice problems tailored to students' needs. (Robert et al., 2023) emphasize that GenAI has great potential to enhance the learning experience by offering personalized and adaptive materials. In this study, students in the experimental class had access to technological support to clarify difficult concepts, thereby making the learning process more interactive and in-depth. The OECD

(2023) also highlights that the application of AI in education can improve learning outcomes, particularly when technology is combined with effective pedagogical strategies. The findings of this study support this view, showing that integrating GenAI with Anticipation Guides significantly improves PGSD students' mathematical literacy.

4. CONCLUSION

Based on the findings of this study, it can be concluded that the Anticipation Guides reading strategy, when integrated with Generative AI (GenAI), has a significant effect on the mathematical literacy skills of PGSD students at the Institut Pendidikan Indonesia. This conclusion is supported by the results of the Independent Samples T-Test, which showed a significance value of 0.000 < 0.05, indicating that H_o was rejected and H_a was accepted. Therefore, it is recommended that lecturers and students utilize this strategy as an innovative learning alternative, integrated into the curriculum by educational institutions, and further examined in other literacy contexts with a broader sample scope to strengthen the research findings.

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