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Phenomenon-Based Approach in Enhancing Academic Achievement among Students in Mathematics

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Abstract: This study examined the effectiveness of the Phenomenon-Based Approach (PBA) versus the Traditional Approach (TA) in teaching mathematics to Senior High School students at Polonuling National High School, Philippines. Using a quasi-experimental design, pretests and posttests measured students' problem-solving skills. While pretest scores showed no significant difference, posttest results favored PBA, highlighting improved critical thinking and conceptual understanding. Statistical analysis confirmed PBA's superior impact on learning. The study advocates for PBA integration into curricula, teacher training, and interdisciplinary collaboration to enhance mathematical learning and 21st-century skills.

Keywords: *Phenomenon-Based Approach (PBA), Mathematics Education, Traditional Teaching Approach, Problem-Solving Skills, Critical Thinking.*

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I. INTRODUCTION

Mathematics education plays a crucial role in developing students' problem-solving abilities, logical reasoning, and critical thinking skills. Over the years, educational systems have evolved, incorporating innovative teaching methodologies to enhance engagement and comprehension. One such approach is the Phenomenon-Based Approach (PBA), which integrates multiple disciplines to explore real-life phenomena, fostering a deeper understanding of mathematical concepts. Countries like Finland and Korea have successfully implemented PBA, demonstrating its benefits and challenges. In the Philippines, the Department of Education (DepEd) promotes context-based and problem-based learning, encouraging the integration of real-world applications in mathematics instruction. Teachers serve as facilitators, guiding students through collaborative investigations that strengthen their conceptual understanding and communication skills.

Despite the increasing adoption of PBA, there remains a lack of empirical evidence on its effectiveness in the Philippine educational setting. Existing research often highlights its general benefits but does not explore its localized application, particularly its impact on instructional practices and student learning outcomes. Additionally, the COVID-19 pandemic has posed challenges in assessing student competencies, necessitating innovative evaluation methods. This study aims to bridge this gap by examining how PBA influences the teaching methodologies of mathematics educators and enhances the problem-solving skills of Senior High School students. By aligning its findings with national educational policies such as Republic Act No. 10533, this research seeks to provide valuable insights into PBA's implementation, ensuring its relevance and effectiveness in the Philippine education system.

II. METHODS

This study employed a quasi-experimental quantitative research design to evaluate the effectiveness of the Phenomenon-Based Approach (PBA) in teaching mathematics. The research aimed to assess how PBA influences instructional practices and enhances students' problem-solving skills. The quasi-experimental approach was chosen as it allows for structured comparisons between different teaching methodologies, such as PBA and traditional teaching methods, without the need for full randomization. Pretests and posttests were administered to both the experimental (PBA) and control (traditional) groups to measure changes in students' mathematical performance. Standardized assessments focused on key competencies,

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including problem-solving, analytical reasoning, and critical thinking.

Data collection involved the use of validated test instruments to ensure reliability and accuracy in measuring student achievement. Statistical tools were employed to analyze pretest and posttest results, determining whether PBA led to significant improvements in learning outcomes. The study site was Polonuling National High School, where Senior High School students participated as respondents. Ethical considerations, such as informed consent and confidentiality, were strictly observed throughout the research process. Additionally, the study took into account the challenges of implementing PBA in local classrooms, ensuring that findings contribute to a broader understanding of how innovative teaching strategies can enhance mathematics education.

III. RESULTS AND DISCUSSION

The study's findings indicate that students in both the Phenomenon-Based Approach (PBA) and Traditional Approach (TA) groups had comparable pretest performance, as demonstrated by the independent t-test ($p = 0.238$). This suggests that both groups started with similar levels of mathematical understanding. However, posttest results revealed a significant improvement in the PBA group compared to the TA group ($p = 0.005$). The mean posttest score for the PBA group ($M = 75.26$) was higher than that of the TA group ($M = 73.01$), with a greater mean gain (6.16 vs. 4.80), indicating that PBA was more effective in enhancing students' mathematical skills.

Furthermore, the distribution of scores showed that nearly all students in the PBA group achieved "Good" or "Very Good" performance levels, while the TA group had a slightly lower concentration of students in these categories. The findings highlight the PBA's role in fostering deeper comprehension and application of mathematical concepts. The results support the integration of PBA into instructional practices, as it promotes critical thinking and engagement. However, successful implementation requires proper training, resources, and curriculum alignment to maximize its benefits in mathematics education**.**

IV. CONSLUSION

The study compared the effectiveness of the Phenomenon-Based Approach (PBA) and the Traditional Approach (TA) in teaching mathematics. Pretest results showed no significant difference between the two groups, confirming that both started with similar levels of mathematical knowledge. However, posttest results indicated that while both approaches improved student performance, the PBA led to significantly better outcomes, as demonstrated by a higher mean score and a statistically significant difference in performance ($p = 0.005$).

The findings suggest that the PBA is a more effective teaching method, as it enhances students' understanding by emphasizing real-world applications and interdisciplinary learning. This approach fosters critical thinking, problem-solving, and deeper engagement with mathematical concepts, unlike the TA, which relies more on rote learning. The study highlights the potential of the PBA to improve mathematics education and better equip students for academic and future success.

➢ *Figures and Tables*

Table 1 Student's Performance in the Pretest in the PBA and Traditional Approach to Teaching Mathematics

Score Equivalent	**Phenomenon**		**Traditional**		**Description**
	f	*%*	*f*	*%*	
90 - 100	0	0	0	0	Excellent
80 - 89	0	0	0	0	Very Good
70 - 79	14	51.85	6	31.58	Good
60 - 69	13	48.15	13	68.42	Fair
Below 60	0	0	0	0	Needs Improvement
Total	27		19		
***M* (SD)**	69.10 (2.30)		68.21 (2.70)		

- *Note. f* = frequency; *%* = percentage; *M* = mean; *SD* = standard deviation.
- Student's Performance in the Pretest in the PBA and Traditional Approach to Teaching Mathematics

Table 2 Post Test Performance of Students in the Phenomenon-Based and Traditional Approaches to Teaching Mathematics

Score Range	**Phenomenon-Based Approach**	**Traditional Approach**	**Description**		
	f	*%*	*f*	*%*	
90–100	0	0.00	0	0.00	Excellent
80–89	1	3.70	0	0.00	Very Good
70–79	26	96.30	18	94.74	Good
60–69	0	0.00	1	5.26	Fair
Below 60	0	0.00	0	0.00	Needs Improvement
Total	27		19		
Mean (SD)	75.26 (2.46)			73.01 (2.35)	

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- *Note. f* = frequency; *%* = percentage; SD = standard deviation.
- Post test Performance of Students in the Phenomenon-Based and Traditional Approaches to Teaching Mathematics

Table 3 Independent Samples t-Test Comparing Pretest Performance Between PBA and TA Groups

Group	M	SD	t	df	p
PBA	69.10	2.30	1.197	44	0.238
TA	68.21	2.70			

- *Note.* PBA = Phenomenon-Based Approach; TA = Traditional Approach.
- Independent Samples t-Test Comparing Pretest Performance Between PBA and TA Groups

Table 4 Independent Samples t-Test Comparing Posttest Performance Between PBA and TA Groups

Variable	Group	M	SD	t	df	p
Post test Score	PBA	75.26	2.46	2.957	44	0.005
	TA	73.01	2.35			

- *Note.* PBA = Phenomenon-Based Approach; TA = Traditional Approach.
- Independent Samples t-Test Comparing Posttest Performance Between PBA and TA Groups

Table 5 Mean Gain in Performance for Phenomenon-Based and Traditional Approaches

Group	Mean Pretest Score	Mean Posttest Score	Mean Gain	Interpretation
Phenomenon-Based	69.10	75.26	6.16	Substantial improvement, indicating effectiveness.
Traditional	68.21	73.01	4.80	Moderate improvement, reflecting incremental learning.

- Mean Gain in Performance for Phenomenon-Based and Traditional Approaches.

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