



Students' Perceptions of the STEAM Learning Model in Developing Literacy and Numeracy Skills

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ABSTRACT

Purpose of the study:

This study aims to determine students' responses to the implementation of the STEAM learning model in developing numeracy literacy. The focus is on how STEAM can enhance students' understanding of numeracy concepts, increase motivation, and foster critical thinking and problem-solving skills.

Methodology:

The study employed a survey research design with 30 student participants. Data were collected using a 10-item questionnaire, where responses were recorded as "Yes" or "No" and converted into percentages. Quantitative analysis was conducted using descriptive statistics to evaluate the effectiveness of the STEAM learning model in the classroom setting.

Main Findings:

Results show that STEAM learning received a generally positive response from students, with the highest score (83.3%) in connecting mathematics to other fields, followed by applying numeracy in daily life (73.3%) and increased learning motivation (73.3%). Technology use (76.7%) and increased interest in mathematics (70%) also showed notable effects. However, collaboration (56.7%) and ease in solving numeracy problems (60%) were identified as areas needing improvement.

Novelty/Originality of this study:

This study provides new insight into the direct impact of STEAM learning on numeracy literacy, an area less explored in existing literature. It highlights specific strengths and weaknesses of STEAM from students' perspectives, offering practical guidance for educators to design more structured, contextual, and interactive approaches to enhance numeracy literacy development.

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1. INTRODUCTION

STEAM-based learning (Science, Technology, Engineering, Arts, and Mathematics) offers a transformative approach to education by integrating mathematical concepts into dynamic, real-world contexts. This interdisciplinary model not only develops essential academic skills but also prepares students to face the practical challenges of an ever-evolving world. A key component of the STEAM approach is strengthening numeracy literacy, which plays a crucial role in fostering analytical and problem-solving skills[1]. By incorporating arts and creativity into the curriculum, STEAM provides innovative pathways for students to deepen their understanding of mathematical ideas and apply them in engaging and meaningful ways[2].

STEAM-based learning emphasizes hands-on activities, collaboration, and real-world applications, making it highly effective in enhancing students' numeracy literacy. Unlike traditional methods that often focus solely on theoretical learning, STEAM enables students to view mathematics as a practical tool for solving problems, rather than just an abstract subject [3]. The integration of technology and engineering within the STEAM framework gives students the opportunity to work with data and models that require advanced mathematical reasoning, which

is essential for strengthening their numeracy skills [4]. Additionally, the incorporation of arts encourages creativity, helping students approach and solve mathematical problems in innovative ways, thereby improving their understanding and engagement with mathematics[5].

This study aims to explore how STEAM-based learning can specifically enhance students' numeracy literacy, an area that has been relatively underexplored in existing research. While numerous studies have demonstrated the benefits of interdisciplinary learning in boosting cognitive and creative abilities [6]; [7], there is limited focus on its direct impact on numeracy literacy. Therefore, this research will provide valuable insights for educators seeking to improve students' mathematical competence and their ability to apply mathematical knowledge in real-world situations.

The significance of this study extends beyond the classroom, as it has the potential to influence future educational practices and policies. In a world where numeracy skills are increasingly essential for success, both academically and professionally, strengthening numeracy literacy is crucial[5]. Through STEAM, students not only develop their mathematical abilities but also acquire vital 21st-century skills such as problem-solving, creativity, and collaboration, which are recognized as essential competencies in today's society [8]; [9]. The findings of this study could serve as a catalyst for broader curricular reforms, encouraging teaching innovations that better prepare students for future challenges.

Moreover, this study will provide educators with practical strategies for integrating STEAM into their teaching, leading to more engaging and effective pedagogical practices. Ultimately, this will help students acquire the numeracy skills they need to succeed academically and in their personal and professional lives [10]. By conducting a comprehensive review of existing literature on the intersection of STEAM and numeracy literacy [11]; [12], this research will establish a solid theoretical foundation and identify best practices for incorporating STEAM into numeracy education, ensuring that students are well-equipped to face the challenges and opportunities of the 21st century [13]; [14]; [15].

2. RESEARCH METHOD

This study used a survey research design to determine students' responses to the STEAM learning model in developing numeracy literacy. The participants in this study were 30 grade X junior high school students who were selected based on the consideration that the class teacher had implemented STEAM-based learning.

The data collection instrument used in this study was a questionnaire designed to gather detailed information about students' responses to the STEAM learning model implemented by the teacher in the classroom. For data collection, a questionnaire was distributed to 30 grade X junior high school students, selected based on the consideration that their class teacher had implemented STEAM-based learning. The questionnaire was designed to gather detailed information about students' responses to the STEAM learning model implemented in the classroom. Students were asked to independently fill out the questionnaire, providing answers based on their personal experiences during the STEAM-based lessons. The collected data from the students' responses formed the foundation for evaluating the effectiveness of the STEAM learning model as applied by the teacher.

The data from students' responses through the questionnaire became the basis for evaluating the learning model implemented by a teacher. The data used in this study were analyzed quantitatively using descriptive statistics.

3. RESULTS AND DISCUSSION

Result Research

This study aims to determine students' responses to the implementation of the STEAM learning model in developing numeracy literacy. STEAM (Science, Technology, Engineering, Arts, and Mathematics) is expected to help students gain a deeper understanding of numeracy concepts, increase their interest in learning mathematics, and develop critical thinking and problem-solving skills. The research instrument was a questionnaire consisting of 10 statements, administered to 30 students, with responses recorded in the form of "Yes" or "No" and then calculated as percentages. The following table presents the students' responses to the STEAM learning model

Tabel 1. Student Response Questionnaire on the STEAM Learning Model in Developing Numeracy Literacy Skills

No	Statements	Respon (30 students)	Percentage (%)
1.	STEAM learning helps students understand numeracy concepts better.	Yes	66,7%
		No	33,3 %
2.	Students' interest in mathematics has increased after using STEAM learning	Yes	70%
		No	30%

3.	Students find it easier to solve numeracy problems when science and technology are involved	Yes	60%
		No	40%
4.	STEAM learning improves students' critical thinking in solving numeracy problems.	Yes	63,3%
		No	36,7%
5.	Hands-on activities in STEAM help students apply numeracy concepts to daily life	Yes	73,3 %
		No	28,7%
6.	Students feel more confident in solving numeracy problems after STEAM learning.	Yes	70%
		No	30%
7.	STEAM learning increases students' motivation to learn numeracy.	Yes	73,3 %
		No	28,7%
8.	STEAM makes it easier for students to collaborate with classmates on numeracy tasks.	Yes	56,7%
		No	43,3%
9.	STEAM helps students connect mathematics with other fields, such as arts or engineering.	Yes	83,3%
		No	16,7%
10.	The use of technology in STEAM helps students understand numeracy concepts better.	Yes	76,7%
		No	23.3%

The results of the study indicate that, in general, STEAM learning received a positive response from the majority of students in developing numeracy literacy. The highest percentage of positive responses was found in the indicator of connecting mathematics with other fields (83.3%), followed by the application of numeracy concepts in daily life (73.3%) and increased learning motivation (73.3%). Other aspects, such as the use of technology (76.7%) and increased interest in learning mathematics (70%), also showed a significant impact. However, there remains a proportion of students (around 16.7% to 43.3%) who have not fully experienced the benefits of STEAM learning, particularly in aspects of collaboration and ease in solving numeracy problems. This indicates the need for more structured, contextual, and interactive teaching strategies so that the benefits of STEAM can be more evenly experienced by all students.

The histogram of the percentage of student response results can also be seen in Figure 1 below.

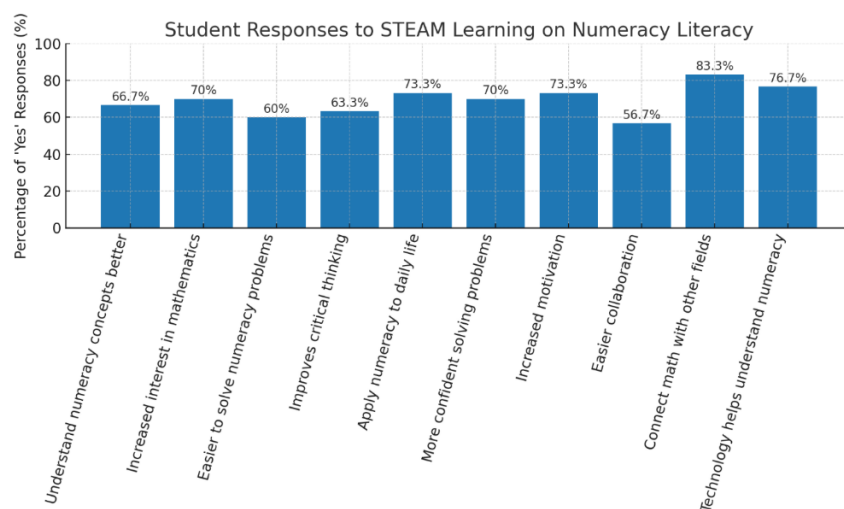


Figure 1. Histogram of the percentage of student response

Visually, the histogram shows that the majority of students responded positively to the implementation of STEAM, with nearly all indicators having percentages above 60%. The variation in percentages indicates that cross-disciplinary connections and the application of concepts to Hreal-life situations are the main strengths, while student collaboration remains an area that needs improvement.

Discussion

The findings of this study indicate that the majority of students responded positively to the implementation of STEAM learning in developing numeracy literacy. The result showing that the indicator of connecting mathematics with other fields obtained the highest percentage (83.3%) aligns with [2], who emphasizes that integrating the arts into STEAM broadens cross-disciplinary connections, allowing students to see how

mathematical knowledge relates to real-world contexts. This is further supported by [4], who demonstrated that integrating challenge-based learning with a STEAM approach enables students to connect numeracy concepts with various fields such as technology, arts, and engineering.

The high positive response in the indicator of applying numeracy concepts to daily life (73.3%) is consistent with [11], who found that STEAM learning allows students to apply numeracy literacy in real-world contexts, making concepts more meaningful. This finding also aligns with [15], who highlighted the importance of linking numeracy learning with local wisdom so that students perceive greater relevance to their environment.

The relatively high percentage for the use of technology (76.7%) supports the findings of [12]; [13], which indicate that the integration of technology in mathematics learning—particularly in technology-rich environments—significantly contributes to improving numeracy understanding and problem-solving skills.

Nevertheless, the results also reveal areas requiring further attention, particularly in student collaboration (56.7%) and ease of solving numeracy problems (60%). These lower scores suggest that collaborative skills are not yet fully facilitated. As [8] points out, collaborative learning is essential for developing 21st-century skills such as communication and critical thinking. Furthermore, [3] highlight that integrating Project-Based Learning (PjBL) into STEAM can enhance critical thinking skills, which are essential for numeracy problem-solving.

This variation in response levels can also be explained by [7], who compared STEM and STEAM and found that while STEAM has advantages in improving student engagement, its success heavily depends on the design of learning activities. Therefore, more structured, contextual, and interactive teaching strategies are necessary to ensure that the benefits of STEAM are evenly experienced by all students.

4. CONCLUSION

This study concludes that the implementation of STEAM learning has generally received a positive response from students in developing numeracy literacy. The highest positive responses were found in the indicators of connecting mathematics with other fields, applying numeracy concepts in daily life, and increasing learning motivation, indicating that STEAM effectively fosters cross-disciplinary thinking, contextual understanding, and student engagement. The integration of technology also showed a significant contribution to enhancing students' comprehension of numeracy concepts.

However, certain aspects—particularly collaboration and ease of solving numeracy problems—received relatively lower responses, suggesting the need for improvement in these areas. To maximize the benefits of STEAM, teaching strategies should be designed to be more structured, contextual, and interactive, ensuring that all students can fully experience its advantages. These findings reinforce previous research on the importance of integrating STEAM with real-life applications, technological tools, and collaborative learning to strengthen numeracy literacy in a comprehensive manner.

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