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Towards Better Numeracy Outcomes: Analyzing Factors and Interventions for Indonesian Students

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Abstract. *Numeracy is essential in many aspects of daily life, yet it remains a growing concern among Indonesian students. Numerous factors contribute to this issue, which must be addressed through pedagogical and psychological approaches. Correspondingly, this research had two main objectives: First, to describe students' performance in basic numeracy skills and the factors that hindered their development, and second, to analyze and map the learning activities students needed to improve their numeracy skills. To achieve these objectives, an ex post facto research design with a quantitative approach was employed. A total of 506 secondary school students from various regions in Indonesia (Female = 285; Male = 221) participated in this study. The sample was collected using a simple random sampling technique. Data was gathered via an online survey of 51 structured questions administered to the students. Multiple statistical tests were conducted to analyze the data, including descriptive statistics (mean scores) and inferential statistics (factor analysis). The findings indicated that the overall mean score for students' basic numeracy skills was moderate, with female students outperforming male students. Additionally, several factors hindered students' mastery of basic numeracy. The study also highlighted the need for more differentiated instruction, where students could receive personalized support based on their unique challenges and learning preferences.*

Keywords*: basic numeracy, hindering factors, learning activities*

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Introduction

Indonesian students' numeracy skills have long been a significant national issue. Over the last 20 years, Indonesian students' participation in the Programme for International Student Assessment (PISA) (from 2002 to 2022) has never reached the average score of OECD students (OECD, 2023). During this same period, the average score of Indonesian students has never exceeded 400 points (OECD, 2023). Most Indonesian students could only perform at Level 2 out of 6 levels in the PISA numeracy assessment, indicating that almost no students in Indonesia were top performers in mathematics. More detailed data show that only 18% of Indonesian students achieved at least Level 2 proficiency in mathematics, significantly lower than the OECD average of 69% achieving the same level (Maulina et al., 2024; OECD, 2023; Susanto et al., 2024)

Various factors can affect students' learning processes and contribute to the deficiency in their numeracy skills. In a broader context, these factors include socio-economic disparities, limited access to quality education, and insufficient emphasis on problem-solving and critical thinking skills within the curriculum (Suratno et al., 2023; Tupamahu et al., 2023). Meanwhile, in more specific contexts such as classroom settings and the teaching and learning process, at least three factors contribute to students' limited numeracy skills: the quality of the teaching methods employed, teacher proficiency in delivering numeracy context, and inadequate learning resources and materials (Saputra et al., 2023; Sibarani & Rianto, 2022; Siregar et al., 2023). Similar challenges are observed globally. International studies also emphasize the role of teaching practices, teacher preparedness, and resource availability in hindering students' numeracy skills development (Martin & Mullis, 2019; UNESCO, 2020). Each factor has different impacts on students' efforts to grasp numeracy skills. Teaching methods that are outdated or fail to address the needs of diverse students can hinder their understanding and application of numeracy skills (Handayani, 2023). Teachers' proficiency in numeracy is critical; those who lack confidence and a deep understanding of mathematical concepts may struggle to convey these ideas effectively, leading to gaps in students' knowledge (Salamah, 2024). Furthermore, teachers with inadequate proficiency tend to see numeracy as merely involving numbers and calculations rather than the ability to understand and work with numbers, applying mathematical reasoning to make decisions in everyday life (Westwood, 2021).

Inadequate learning resources, such as insufficient access to textbooks, media, or the integration of technology into the learning process, can limit students' opportunities to engage with numeracy in meaningful ways, further exacerbating learning gaps (Febriani et al., 2024; Latifah & Sujarwo, 2023). Without adequate resources, students are less likely to develop a deep understanding of numeracy skills because effective learning, especially in numeracy, requires access to diverse and engaging materials that reinforce concepts through practice, visualization, and real-world application (Kandakatla et al., 2020; Tanis, 2020). Studies have found that students in resource-rich environments consistently outperformed their peers in resource-constrained settings, not only in terms of basic numeracy but also in applying mathematical reasoning to complex problems (Castro-Alonso et al., 2021; Chew & Cerbin, 2020). Furthermore, the absence of such resources often results in rote learning, where students memorize procedures without fully understanding the underlying principles. Consequently, their knowledge becomes fragile and deteriorates over time. This situation also prevents students from connecting the theoretical framework of numeracy to their everyday

experiences. Addressing these factors is essential for improving students' numeracy outcomes and ensuring equitable access to high-quality mathematics education.

One of the best ways to address the hindering factors is through pedagogical interventions focusing on improving teaching strategies and accommodating students' needs with diverse instructional approaches. One promising approach is implementing a differentiated flipped classroom model supported by digital modules tailored to various learning preferences and paces (Dack & Tomlinson, 2024; Vijayan & Nasri, 2022). This approach allows teachers to provide more personalized support to students' learning, ensuring that those who struggle with abstract concepts of numeracy receive the concrete examples they need to better understand the material (Ammade et al., 2023; Faisal & Adi, 2023).

Given the critical importance of numeracy skills in daily life and the concern about the numeracy levels of Indonesian students, it is essential to explore and address the underlying issues contributing to these deficiencies. Numerous studies have examined students' numeracy performance, both locally and internationally. Some Indonesian research (Diarni et al., 2023; Susanta et al., 2022; Wulan & Astuti, 2022) has explored students' numeracy performance. However, there is a need for more comprehensive analyses of the factors hindering numeracy mastery. On a global scale, international studies (Martin & Mullis, 2019; OECD, 2023) have also highlighted similar challenges, including teaching quality, resource availability, and instructional methods. Correspondingly, the present study aimed to provide a comprehensive overview of students' basic numeracy levels, identify the key factors hindering their mastery of basic numeracy and analyze and map the specific learning activities that can help students excel in numeracy. Therefore, the central research questions guiding this study were (1) How do Indonesian students perform in basic numeracy skills? (2) What are the main challenges students encounter in understanding mathematical concepts and applying those concepts to real-life situations? and (3) What learning activities are required to help students excel in numeracy? Answering these questions can serve as a stepping stone and foundation for designing alternative approaches in teaching, such as differentiated flipped classrooms, that can enhance students' numeracy skills in Indonesia and similar educational contexts worldwide.

Method

The objectives of this research were two-fold: first, to describe the performance of students' basic numeracy skills and the factors that hindered them; second, to analyze and then map the learning activities that students needed to excel in numeracy. To achieve these objectives, an ex post facto study rooted in a quantitative research method was utilized. A total

of 506 randomly selected secondary school students (Female = 285; Male = 221) participated in this study. The sample students come from nine different provinces in Indonesia (West Java, Central Java, East Java, Lampung, Kepulauan Riau, East Kalimantan, South Kalimantan, Nusa Tenggara Timur, and Southeast Sulawesi). To collect the data, an online survey was administered to students, consisting of 56 structured questionnaire items. This questionnaire was used to gather data on students' basic numeracy skills, the factors that hindered students' understanding of numeracy, and the learning activities students needed to excel in numeracy. The general rubric of the data collection instrument is presented in Table 1.

Table 1. The rubric of the questionnaire

Aspect	Description	Type of Data	Data Source
Basic Numeracy Skills	Numbers Basic Arithmetic Simple Algebra Geometry Simple Statistics Proportion Probability	Ratio	Study Results
Barriers to Grasp Numeracy	Abstract Concept of Numeracy: a. Difficult to imagine abstract mathematical concepts b. Mathematics lessons are too theoretical with minimal real-world application c. Minimal multimedia integration while explaining mathematical concepts	Ordinal	Survey
	Knowledge Transfer: a. Difficulty applying mathematical concepts in everyday life b. Hard to connect mathematical concepts to daily experiences c. Lack of confidence in using mathematics in real-life situations d. Hesitant to apply mathematical concepts in problem-solving	Ordinal	Survey
	Math Anxiety: a. Difficulty concentrating due to anxiety during math b. Fear of making mistakes c. Avoiding participation due to anxiety d. Reluctant to attend school because of math e. Anxiety negatively affects learning outcomes f. Loss of interest in math due to anxiety	Ordinal	Survey
	Learning Strategies: a. Learning material does not match the student's ability level b. Learning material does not meet students' needs c. The use of technology and learning media is inadequate	Ordinal	Survey
Preferred Learning Activities	The Use of Learning Media Constructive Feedback on Errors Game-based Interactive Learning Project-based learning Variation of Learning Resources Social Interaction Through Discussion Hands-on Activity Contextual Learning Written Test-based Assessment Integration of Technology in Assessment Cumulative Assessment Exam Scores Do Not Determine Final Grades	Ordinal	Survey

The researchers developed each item in the questionnaire through a synthesis of relevant literature on common barriers to students' understanding of numeracy (Diarni et al., 2023; Fauzan et al., 2024; Furner & Duffy, 2022; Klee et al., 2021) and commonly preferred learning activities in mathematics (Faulconer et al., 2022; Fauzan et al., 2024; Gan et al., 2021; Nurjanah et al., 2020). This synthesis was guided by the constructivist learning theory, emphasizing the importance of active learning and individual cognitive processes in overcoming learning barriers. In designing questions, Thorndike's Laws of Learning, particularly the Law of Effect and the Law of Exercise, were also considered to identify how repeated practice and reinforcement affected students' numeracy skills. The synthesized instrument then underwent tests for validity and reliability. The validity test used was Pearson's Product-Moment Correlation, while the reliability test applied Cronbach's Alpha. The results are presented in Table 2 and Table 3.

Table 2. Validity test of the questionnaire

Aspect	Average r-value	Rtable	Sig.	Status
Barriers to Understanding Numeracy	0.5227	0.0872	0.001	Valid
Preferred Learning Activities	0.459	0.0872	0.001	Valid

Table 3. Reliability test of the questionnaire

Aspect	Cronbach's Alpha Value	Status
Barriers to Understanding Numeracy	0.853	Reliable
Preferred Learning Activities	0.650	Reliable

Based on the data presented in Tables 2 and 3, it can be inferred that all the questionnaire items were valid and reliable for use in this study. Multiple statistical tests were employed to analyze the data. In this regard, various statistical tests could allow for a more comprehensive examination of the data from different perspectives (Franke et al., 2017). Descriptive statistics were used to analyze the mean scores of students' basic numeracy skills and their perspectives on factors hindering their understanding of numeracy. Additionally, the collected data were analyzed using inferential statistics through structured factor analysis, including Exploratory Factor Analysis (EFA), Eigenvalue analysis, and Varimax rotation, to identify patterns and trends in learning activity needs. This method could help reduce the complexity of the data by summarizing it into a smaller number of factors without losing significant information. This reduction was crucial in the need analysis of learning activities, as it allowed researchers to focus on the most impactful activities (Goretzko et al., 2021). By summarizing the data into fewer factors, EFA reduced complexity while preserving essential information, enabling researchers to concentrate on the most significant learning activities (Osborne et al., 2008). This reduction was vital in needs analysis, as it helped identify core areas requiring intervention. The

results from this analysis would serve as a foundation for designing differentiated flipped classrooms to improve students' numeracy skills in the next phase of this research.

Results and Discussion

Students' Basic Numeracy Skills

Table 4 portrays the students' basic numeracy skills overall.

Table 4. Students' basic numeracy skills

Gender	Mean Score	Minimum Score	Maximum Score	Std. Deviation
All Students	56.58	22.86	98.57	18.06
Female Students	60.09	22.86	98.57	16.87
Male Students	52.06	22.86	97.14	18.55

The data presented in Table 4 indicate that students' numeracy skills ranged from low to moderate levels regarding overall results. The scores ranged from a minimum of 22.86 to a maximum of 98.57, highlighting a wide disparity in student performance. Regarding gender, female students had a higher mean score (60.09) than the overall mean, suggesting better performance in numeracy skills. In addition, female students outperformed male students in numeracy. Individual scores for each aspect of numeracy skills are displayed in Table 5.

Table 5. Students' scores for each aspect of basic numeracy

No	Aspect	Mean Score
1	Numbers	58.696
2	Basic Arithmetic	69.407
3	Simple Algebra	51.028
4	Geometry	60.613
5	Simple Statistics	55.020
6	Proportion	49.289
7	Probability	52.372

As observed from the data displayed in Table 5, regarding individual scores for basic numeracy skills, students' comprehension related to the proportion aspect had the lowest mean score, while basic arithmetic had the highest. The remaining aspects tend to be at a low to moderate level. A detailed elaboration of each finding is further discussed below.

Numeracy skills have been a crucial issue among Indonesian students. Both international assessments, such as PISA and TIMSS, and national assessments, have reported that most Indonesian students struggled to cope with numeracy (Fauzan et al., 2024; OECD, 2023). This research revealed similar outcomes, showing that most students only performed moderately in basic numeracy. Numerical deficiency indicated that most students had not mastered the building blocks necessary for higher-level math and problem-solving (Wijaya et al., 2015). The finding that students' mean score in simple algebra was relatively low (51.028) compared to other aspects, such as basic arithmetic (69.407), was particularly noteworthy. This finding suggests that while students could perform basic arithmetic calculations, they struggled with

applying algebraic reasoning, which requires higher-order thinking and abstract problem-solving skills. Algebra is a foundational skill that underpins many advanced mathematical concepts, and this deficit may hinder students' overall mathematical development. The higher mean score of female students compared to their male counterparts, as revealed in this study, aligns with findings from international assessments like PISA (OECD, 2023; Rahmadhani et al., 2024). In this regard, girls tend to be more diligent in their studies, participate more actively in class (OECD, 2023), and seek help more readily than boys. These practices might promote numeracy performance, as they allow students to learn from their peers' questions and insights, keeping them mentally engaged and attentive, which enhances learning and retention of mathematical concepts (Roche et al., 2023; van den Berg, Singh, Komen, Hazelebach, van Hilvoorde, & Chinapaw, 2019).

Key Factors Limiting Students' Basic Numeracy Skills

Numerous previous studies have addressed factors that hindered students from comprehending basic numeracy. Findings from this research might support previous studies or add further insights. The data in Table 6 highlight key aspects that limited students' numeracy skills. As displayed in Table 6, out of the 16 factors across 4 aspects, one significant factor from each aspect hindered students from mastering basic numeracy (see factors marked with *). The discussion in this paper focused on these four factors. Additionally, it suggests actions we can take to tackle these factors.

Table 6. Factors hindering students from comprehending basic numeracy

Barriers to Understanding Numeracy	Mean Score	Std. Deviation
Abstract Concept of Numeracy		
It is hard to imagine abstract mathematical concepts*	3.65	0.793
The mathematics lessons taught are too theoretical, with minimal real-world application examples	2.91	0.988
Multimedia is rarely integrated when explaining mathematical concepts	3.59	0.840
Knowledge Transfer		
It is difficult to apply mathematical concepts in everyday life	3.35	0.892
It is hard to connect mathematical concepts to everyday life	3.49	0.802
Less confidence in using mathematics in everyday life	3.23	0.936
Hesitant to apply mathematical concepts in problem-solving*	3.66	0.936
Math Anxiety		
Hard to concentrate due to anxiety when facing math	3.48	1.114
Afraid of making mistakes*	3.61	1.188
Avoiding participation due to anxiety	2.50	1.152
Not wanting to go to school because of mathematics	2.10	1.239
Anxiety negatively affects learning outcomes	3.07	1.217
Losing interest in mathematics due to math anxiety	2.66	1.228
Learning Strategies		
The learning material does not match the level of ability	3.02	0.936
The learning material does not meet learning needs*	3.31	0.915
The use of technology and learning media is inadequate	3.05	0.864

Abstract concepts in mathematics often require a level of cognitive maturity that younger students may not yet have fully developed. Students frequently struggled with abstract mathematical concepts because they lacked concrete experiences to relate to real-life situations. To address this barrier, teachers should use concrete representations and real-life examples to explain abstract mathematical concepts. This approach can help students correlate abstract ideas with concrete experiences (Calor et al., 2022; Grimm et al., 2023). One of the most effective ways to provide concrete representations is using multimedia teaching tools. These tools can help bridge the gap between abstract concepts and students' understanding, as multimedia resources offer visual and interactive ways to explore mathematical ideas, making them more engaging and comprehensible (Abdulrahaman et al., 2020).

Students' hesitation to apply mathematical concepts in problem-solving was linked to psychological, educational, and socio-cultural factors. Many students experienced anxiety when faced with mathematical tasks, leading to avoidance and hesitation. This anxiety often stemmed from a fear of failure or past negative experiences with math (Furner & Duffy, 2022; Klee et al., 2021). Thus, teachers should provide positive reinforcement and create a supportive learning environment encouraging risk-taking and resilience (Nathan & Alibali, 2021; Umah et al., 2023).

There are numerous causes of math anxiety, one of which is negative experiences with math that could create a lasting fear of the subject. Students with high levels of math anxiety tend to avoid math-related activities. They are more likely to fear making mistakes, as errors could exacerbate their anxiety and reinforce negative perceptions of their abilities (Szczygieł & Pieronkiewicz, 2021). This fear might lead to avoidance behaviors, where students shy away from participating in mathematical activities to avoid the possibility of making errors (Ramirez, 2018; Tomasetto et al., 2021). To address this, teachers should foster a learning environment where mistakes are viewed as a natural part of the learning process (Murphy & Gash, 2020; Wang et al., 2023). By normalizing mistakes, teachers can reduce the anxiety and stress associated with making errors. This condition may increase participation and curiosity as students feel more comfortable experimenting and exploring new concepts (Susanta et al., 2022).

Another significant barrier was learning materials that did not meet students' needs. Student success in numeracy was significantly hindered when learning materials failed to address the diverse needs of students. This misalignment could create substantial obstacles to mastering essential mathematical skills, leading to widespread difficulties in numeracy comprehension and application. When learning materials were either too advanced or too simplistic, students became overwhelmed or bored, which could impede learning (Reich, 2020).

To address this situation, teachers should implement differentiated instruction that aligns with students' varying ability levels, interests, and learning preferences. Through differentiated instructions, students' learning paths could be personalized according to their level of understanding and skill (Tomlinson & Imbeau, 2023). Differentiated instruction also incorporates various instructional strategies to manage classroom dynamics, ensuring that all students receive the support they need while maintaining an organized and productive learning environment.

Students' Preferred Learning Activities for Excelling in Numeracy Skills

The barriers to numeracy, as outlined in Table 6, must be addressed through comprehensive pedagogical interventions. One approach was to design learning activities that could meet students' needs. Initially, twelve learning activities were identified as potentially favorable to students. These activities were then subjected to factor analysis tests to determine whether they belonged to a single or multiple factors. Tables 7 and 8 below illustrate the overall Exploratory Factor Analysis (EFA) process used to map students' preferred learning activities.

Table 7. Initial eigenvalue to determine preferred learning activities

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	2.668	22.231	22.231
2	1.341	11.172	33.404
3	1.150	9.586	42.989
4	1.058	8.820	51.809
5	0.960	7.996	59.806
6	0.857	7.141	66.947
7	0.772	6.432	73.379
8	0.697	5.808	79.187
9	0.677	5.644	84.831
10	0.638	5.319	90.150
11	0.631	5.262	95.412
12	0.551	4.588	100.000

Data displayed in Table 7 identifies four distinct factors that explain the total variance, each with initial eigenvalues greater than one. Factors with eigenvalues greater than 1 were considered significant in explaining the variance in the dataset, and these factors helped classify the activities into meaningful groups based on their loadings. Together, these four factors account for 51.809% of the total variance. (1) Factor 1 has an eigenvalue of 2.668, explaining 22.231% of the total variance, making it the most dominant component. (2) Factor 2 has an eigenvalue of 1.341, contributing 11.172% of the total variance, and remains relatively dominant. (3) Factor 3 has an eigenvalue of 1.150, explaining 9.586% of the variance,

indicating a moderate impact on the data. (4) Factor 4 has an eigenvalue of 1.058, explaining 8.820% of the variance, showing that it still plays a significant role.

These factors represented four distinct categories of preferred learning activities, as identified through the analysis. In particular, Factor 1 represented the most influential construct within the data and would be prioritized in further analysis due to its greater dominance in explaining the variance. Additionally, six specific teaching and learning activities were found to have high factor loadings on Factor 1 (refer to Table 8, data marked with *). This grouping suggests that these activities contributed significantly to the most dominant component, accounting for over half of the explained variance. The six activities mapped in this study offered unique ways to foster a comprehensive and effective learning environment. Elaboration on each activity is further discussed below.

Table 8. Correlation of preferred activities to factor

Rotated Component Matrix

	Component			
	1	**2**	**3**	**4**
The Use of Learning Media*	0.488	0.248	-0.301	-0.503
Constructive Feedback on Errors*	0.501	0.365	0.079	0.149
Game-based Interactive Learning	0.154	0.692	0.171	-0.117
Project-based learning	-0.016	0.053	0.766	0.153
Variation of Learning Resources*	0.594	0.094	0.305	0.095
Social Interaction Through Discussion	0.114	0.111	0.763	-0.042
Hands-on Activity*	0.629	0.134	0.227	-0.060
Contextual Learning*	0.437	0.078	-0.064	0.145
Written Test-based Assessment	0.161	0.553	0.356	0.167
Integration of Technology in Assessment*	0.624	-0.066	-0.173	-0.272
Cumulative Assessment	-0.007	0.151	0.004	0.812
Exam Scores Do Not Determine Final Grades	0.222	0.026	0.113	0.715

***Most preferred learning activity**

The effective use of learning media could enhance student engagement, improve understanding, and accommodate various learning preferences. First, multimedia presentations could capture students' attention more effectively than traditional lecture methods (Aulia et al., 2024) due to the multimodal characteristics of digital media. Second, interactive media, such as simulations and virtual labs, allowed students to experiment and observe outcomes in a controlled environment, deepening their understanding of complex concepts (Lestari et al., 2023). Third, learning media could accommodate various preferences by offering personalized learning experiences. Additionally, multimedia resources could significantly enhance learning outcomes by making content more accessible and engaging.

Feedback is critical to learning as it helps students recognize their mistakes and learn accordingly (Gan et al., 2021). Constructive feedback can enhance students' motivation toward learning by understanding their errors and providing strategies for improvement. When delivered appropriately, constructive criticism helps students recognize their growth potential,

thus maintaining their commitment to learning (Faulconer et al., 2022; Wanner & Palmer, 2018). This type of feedback not only points out errors or areas for improvement but also challenges students to think deeply about their assumptions and the knowledge they have acquired (Mohamad & Tasir, 2023). Additionally, feedback promotes self-regulation, allowing students to adjust their strategies based on feedback and enhancing their ability to monitor and evaluate their learning progress.

As shown in Table 8, utilizing various learning resources was students' third most preferred method to help them excel in numeracy. A diverse range of resources, including textbooks, online articles, and practical materials, could accommodate different learning preferences and improve numeracy comprehension by meeting students' varied sensory and cognitive needs. The key point was providing students with rich learning resources. When students can choose resources that match their preferences, they tend to display higher levels of engagement and satisfaction (Haleem et al., 2022; Hardiansyah & Mulyadi, 2022). Moreover, integrating textual, visual, and practical examples into teaching could help students connect theoretical knowledge with real-world applications, thereby deepening their understanding and retention of material. In addition, when educational content is delivered through varied formats, it could encourage students to interact with the material in greater depth (Szabo et al., 2020; Tong et al., 2020).

Hands-on activities became the most preferred learning method, as displayed in research findings. Learning through hands-on activities involves direct engagement with materials and concepts, promoting active learning. This could lead to a better understanding of numerical contexts, improved problem-solving skills, increased engagement and motivation, and better knowledge retention. Through hands-on activities, students were physically and mentally engaged in learning, which increased their interest and investment in the material, ultimately leading to higher academic achievement (Tal & Dallashe, 2021). These activities could help concretize abstract mathematical concepts through practical application. By translating abstract concepts into tangible experiences, students could better understand and internalize mathematical principles (Alsina & Salgado, 2022).

Contextual learning links educational content to real-life situations, making learning more relevant and meaningful. This approach is grounded in the idea that learning occurs best when connected to the real world and that knowledge should be applied to practical situations. In numeracy, when mathematics was taught through real-life problems, such as budgeting or geometry in architecture, students demonstrated increased involvement and interest in learning (Babu et al., 2023; Hwang et al., 2020). Contextual learning helps students see the value and purpose of their studies, motivating them to engage more deeply with the material. Regarding

students' understanding and knowledge retention, contextual learning enhanced these aspects by integrating educational content with real-world scenarios (Green et al., 2020; Muñoz-Campos et al., 2020).

Integrating digital technology in assessment emerged as one of students' most favorable learning activities. Considering that most students involved in this study were digital natives, this need was unsurprising, as it could offer more dynamic and interactive ways to evaluate learning while providing precise, real-time feedback that could significantly improve educational outcomes. Features offered by digital technology in assessing students' learning could significantly increase engagement levels among middle school students, who might otherwise find traditional paper-based tests unstimulating (Mendoza et al., 2023; Zainuddin et al., 2020). Another advantage of technology-enhanced assessments is the ability to provide immediate, personalized feedback. Individualized feedback is particularly important for students aged 12-15, who are at a critical stage of developing their academic and self-regulation skills. During these school years, students encounter more complex and challenging academic content, requiring a deeper level of cognitive engagement and personal responsibility for learning (Wood et al., 2018). Hence, providing personalized feedback during this time could help students understand their strengths and areas for improvement, which is essential for fostering a growth mindset.

Conclusion

The lack of basic numeracy skills among students, as presented in this study, added another bitter pill to swallow alongside ongoing reports about Indonesian students' numeracy challenges. Several dominant factors hindered this comprehension, as identified in this study, ranging from difficulties in knowledge transfer and struggles in understanding the abstract concepts of numeracy to psychological and pedagogical factors such as math anxiety and instructional strategies used in learning. To address these obstacles, several preferred learning activities were successfully mapped based on students' needs. These six activities included frequent use of learning media to clarify abstract numeracy concepts, providing constructive feedback on errors, utilizing various learning resources to expose students to diverse problem-solving methods, regular hands-on activities to promote active learning, implementing contextual learning to make lessons more relevant and meaningful, and integrating technology in assessments to make them more dynamic and interactive. These preferred activities should be incorporated into teaching and learning processes. One effective way to implement such personalized and well-prepared learning is through a differentiated flipped classroom, which combines flipped learning with differentiated instruction to accommodate the findings of this

research. This instructional design can address diverse learning needs and enhance students' numeracy skills.

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