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Jurnal Penelitian dan Pengembangan Pendidikan
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Vol. 12 No. 3 : July 2025
E-ISSN: 2722-4627
pp. 866-875

Analysis of Students' Numeracy Literacy Ability in Solving Three Variable Linear Equation System (SPLTV) Problems Based on Learning Styles

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Abstract: This study aims to analyze students' numeracy literacy skills in solving Three Variable Linear Equation System (SPLTV) problems based on learning styles, namely visual, auditory, and kinesthetic. This study uses a qualitative approach with a case study design. The subjects were three students of class X at SMAN 88 Jakarta, selected using purposive sampling technique. Data were obtained through learning style questionnaires, numeracy literacy ability tests, interviews, and documentation, then analyzed using triangulation techniques to ensure data validity. The results showed that students with visual learning styles had quite good abilities in the aspect of mathematical modeling and making conclusions. Students with an auditory learning style show better ability to understand information, create mathematical models, interpret results and draw conclusions appropriately. Students with kinesthetic learning styles have quite good ability to interpret results and conclude results practically. Although each learning style has its own advantages, auditory learning styles tend to be better at achieving numeracy literacy skills than visual and kinesthetic learning styles. This study shows the importance for educators to understand the learning styles of students in order to be able to implement appropriate learning strategies and the researcher is further advised to consider other factors to gradually improve numeracy literacy skills.

Article History
Received: 06-05-2025
Revised: 09-06-2025
Accepted: 23-06-2025
Published: 25-07-2025

Key Words:
Numeracy Literacy;
SPLTV;
Learning Style.

How to Cite: Fitriyani, A., & Pradipta, T. (2025). Analysis of Students' Numeracy Literacy Ability in Solving Three Variable Linear Equation System (SPLTV) Problems Based on Learning Styles. *Jurnal Paedagogy, 12*(3), 866-875. doi:https://doi.org/10.33394/jp.v12i3.16169

https://doi.org/10.33394/jp.v12i3.16169

Introduction

In the world of education, students are expected to have the ability to solve mathematical problems related to contextual situations in real life. This ability requires students to understand, analyze and apply mathematical concepts in a contextual form. Through numeracy literacy, students not only learn to solve problems but are also trained to think critically in making logical decisions and relate mathematics to real life, so numeracy literacy skills play an important role in the mathematics learning process (Pulungan, 2022).

Numeracy literacy is a person's ability to interpret and use numbers related to daily life problems. Numeracy literacy can be presented in a variety of forms, such as graphs, tables and diagrams and include the ability to interpret the results of analysis in making informed decisions (Sari & Aini, 2022). It can be concluded that numeracy literacy is a person's ability to solve mathematical problems related to daily life. Numeracy literacy skills in Indonesia are still relatively low. In the field of numeracy literacy, most students in Indonesia still show low ability, data shows that students below level two which is the limit of basic numeracy literacy ability (Yuda & Rosmilawati, 2024). Low numeracy literacy ability has a negative impact on various aspects of life, job opportunities, mental well-being, physical health and economic stability, so numeracy literacy skills play an important role in

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Vol. 12 No. 3 : July 2025
E-ISSN: 2722-4627
pp. 866-875

improving one's understanding. (Pulungan, 2022) explained that there are weaknesses in students' numeracy literacy skills, such as students' inability to record information known and asked, mistakes in solving problems, calculation errors, and not being able to conclude the results of answers, especially in story questions.

Numeracy literacy is a part of mathematics that includes the ability to understand, apply and use the concept of computational operations in daily life (Alifia et al., 2021). In mathematics learning, numeracy literacy is a skill that involves understanding the concept of numbers and using them effectively in various life situations. With numeracy literacy skills, we can use easy concepts to solve mathematical problems in daily life, by using interpretation results and analysis results to get the right results (Nurcahyono, 2023). In solving contextual problems, it is generally used to use story problems as a learning medium. The questions made to develop students' numeracy literacy related to this story question are the basic concept of contextual numeracy literacy (Mahmud & Pratiwi, 2019). It may be deduced that numeracy literacy with stories is interrelated. Mathematics material that is often related to daily life is linear equation material (Rahardjo & Waluyati, 2011). The results of previous research suggest conducting research at higher education levels such as high school or equivalent related to students' literacy and numeracy skills in linear equation material (Pulungan, 2022). If this research is carried out at the high school level or equivalent, then the story questions in the material SPLTV can be used to determine the numeracy literacy ability of students.

The SPLTV is an equation system that contains more than one three-variable linear equation with the same set of variables. This material is considered to have a high level of difficulty because most of it uses questions related to daily life (Debi et al., 2021). Story questions aim to provide encouragement to students so that they can predict material concepts related to daily life. Choosing algebraic materials such as a three-variable linear equation system can affect students' numeracy literacy skills (Rachmawati et al., 2024). The story questions in the SPLTV material are very related to daily life problems, problems in more complex questions that support aspects of numeracy literacy skills and there are various types of questions with various problems (Jelita et al., 2024). Therefore, the use of story questions from SPLTV materials is effectively used to analyze students' numeracy literacy skills.

An individual's ability in numeracy and literacy is affected by various factors. These factors come from within the student and from the environment around the student who is interconnected in the development of these skills. The supporting factor for numeracy literacy ability is learning style (A.Rosidi, M.Nimah, 2022). According to the findings of the study (Septyan Setiyawati et al., 2024) A cause of numeracy literacy ability is learning style and suggests further research to identify various factors that can affect numeracy literacy ability.

Learning style is a method used by a person to receive, understand and analyze information in a way that suits their abilities. Learning style refers to the method that students adopt to remember, think, get information and solve problems in problems (Mursari, 2020). Learning styles can help students understand information, make it easier for students to learn and communicate (A.Rosidi, M.Nimah, 2022). If we understand our learning style, then it will be easier for us to create a more effective learning atmosphere. Learning styles are divided into 3, namely: visual, auditory, and kinesthetic (Yerizon et al., 2023). Visual learning style: learners complete by drawing and they prefer to replace sentences of information using symbols and initials they understand (Nurzaki Alhafiz, 2022). Auditory learning style: students prefer to dialogue in internal and external ways and present results in a loud voice (Nurzaki Alhafiz, 2022). Kinesthetic learning style: students are more active in

Vol. 12 No. 3 : July 2025
E-ISSN: 2722-4627
pp. 866-875

understanding the material directly with practice or physical involvement in learning, absorbing information by actively moving, trying and experiencing what is being learned on their own (Nurzaki Alhafiz, 2022). Learning styles with numeracy literacy skills have mutually supportive relationships (Yerizon et al., 2023). By understanding students' learning styles, they can effectively build good numeracy literacy skills to achieve more relevant educational goals according to the needs of students. Research results (Karmeliana & Ladyawati, 2023) it was mentioned that learners who prefer visual learning styles struggle to express everyday issues using symbols and mathematical language. Individuals with auditory learning styles struggle to depict mathematical concepts in models and to use mathematical symbols accurately. At the same time, learners who have a kinesthetic learning style face difficulties in writing mathematical symbols and reaching correct conclusions. In mathematics learning, which is often applied in various approaches to understand abstract concepts, learning styles have advantages and disadvantages. Therefore, educators need to implement learning that integrates visual, auditor, and kinesthetic learning styles in a balanced manner. This research aims to analyze student's ability in numeracy literacy when tackling Three-Variable Linear Equation System problems, considering their different learning styles : visual, auditory and kinesthetic. Ultimately, this research seeks to contribute to the development of more effective learning strategies tailored to meet the diverse needs of students.

Research Method

This study uses a qualitative method with a case study approach to analyze students' numeracy literacy skills in solving the Three Variable Linear Equation System problem reviewed from learning style. Qualitative methods were chosen because they were able to provide understanding in a natural context (Sugiyono, 2010), while case studies allow intensive exploration of the subject in a limited scope through various data collection techniques (Assyakurrohim et al., 2022). This research was carried out at SMAN 88 Jakarta by involving all students of class X as the initial population. A total of three subjects were selected using the purposive sampling technique. Subjects were selected based on the results of the learning style questionnaire and the numeracy literacy ability test. The subject selection criteria include: (1) students have a tendency to have a dominant learning style (visual, auditory, or kinesthetic), (2) students are willing to participate in research and interview processes, and (3) students are able to solve numeracy literacy test questions well.

The research instrument consists of three types, namely: learning style questionnaire, numeracy literacy ability test and interview guidelines. The learning style questionnaire was compiled based on visual, auditory, and kinesthetic models. The numeracy literacy ability test is prepared based on numeracy literacy indicators, which include communication skills, problem solving, interpreting and writing conclusions. Interview guidelines are used to find out the thinking process and strategies of students in solving the Three-Variable Linear Equation System problems according to their learning style. The research instruments that have been made are then validated by mathematics education lecturers, then validated by high school mathematics teachers.

Data was collected through questionnaires, tests, interviews and documentation. This study uses triangulation techniques to ensure the validity of the data. The data analysis process is carried out through three stages, namely: data reduction, data presentation, and conclusion drawn. Students who are selected as subjects will be coded based on the following categories: visual learning style (SV), auditory learning style (SA), kinesthetic learning style

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Email:paedagogy@undikma.ac.id

Vol. 12 No. 3 : July 2025
E-ISSN: 2722-4627
pp. 866-875

(SA), and researcher (P). The test instruments used in this study are based on indicators of numeracy literacy ability (Kemendikbudristek, 2021)

No	Indicator	Description	Question Number
1.	Communication	Students have the ability to record known and asked information based on the data provided in the question, whether in the form of (graphs, tables, or charts).	1-3
2.	Troubleshooting	Students are able to apply mathematical models using numbers and symbols to solve problems in daily life appropriately.	1-3
3.	Interpretation and Conclusion	Students are able to solve problems in the questions and make appropriate conclusions.	1-3

Figure 1. Numeracy Literacy Ability Indicators

Figure 1 is the indicators of test instruments used to measure students' numeracy literacy ability. This instrument was compiled to check the outcomes of the students' numeracy literacy ability test. This test instrument has gone through a validation process carried out by two experts, namely a mathematics teacher and a mathematics education lecturer.

Results and Discussion

According to the outcomes of the learning style assessment and the numeracy literacy ability test administered to 106 students, 3 students were selected as the main subjects for the research. The subjects were chosen based on their learning styles, allowing for a more in-depth analysis of numeracy literacy abilities. The test included 3 questions focused on SPLTV material. By examining the outcomes from the learning style questionnaire, the numeracy literacy test, and student interviews, researchers obtained more detailed insights from each research subject.

Analysis of Numeracy Literacy Ability Test and Interview on Visual

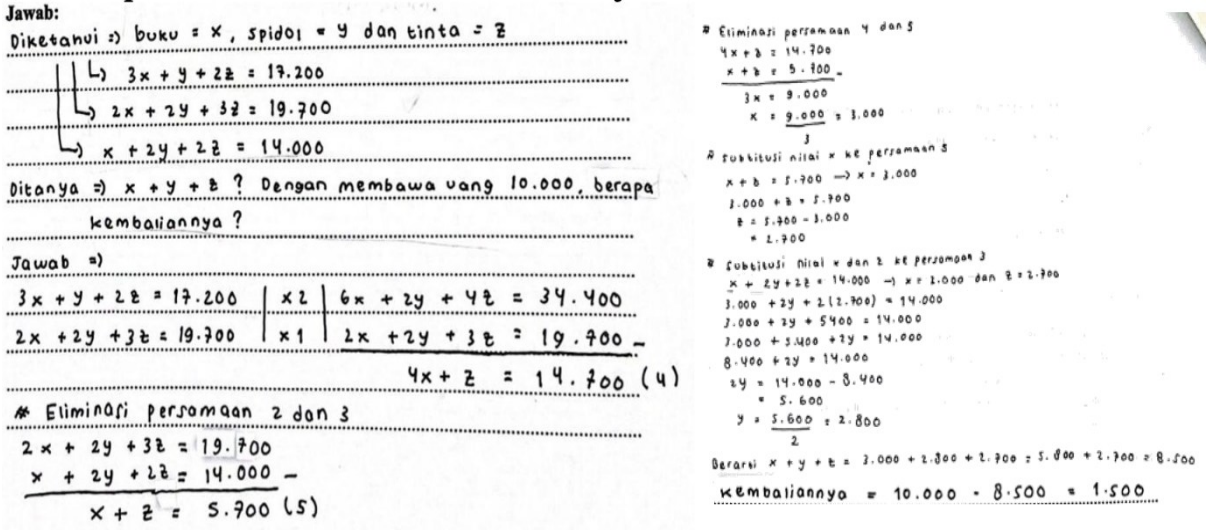

Figure 2. Visual Subject Answers

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Jurnal Penelitian dan Pengembangan Pendidikan
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Email:paedagogy@undikma.ac.id

Vol. 12 No. 3 : July 2025
E-ISSN: 2722-4627
pp. 866-875

Figure 2, In the question, SV has not been able to write record the details that are already known and requested in the question, so it is not by the first indicator of numeracy literacy. In addition, SV can write numbers and symbols into the mathematical model correctly to solve problems in the problem according to the second indicator of numerical literacy proficiency. SV is also able to interpret the results and write conclusions appropriately according to the three indicators of numeracy literacy ability.

The subsequent details outline the outcomes of the researcher's conversation with the participant:

P : How do you understand the question and write the information on the question?
SV: I read the question in its entirety, after that I read what is asked in the question, then I make an example using the variables x, y, and z
P : Why do you use these variables to make an example of a problem?
SV: I use the variable because I want to adjust to the information of the question
P : Are there any difficulties in understanding and writing down the information in the question?
SV : I don't find it difficult when working on questions
P : How do you translate the information in the problem into a mathematical model?
SV: The first step I made an example using variables, after that I made a mathematical model according to the information in the problem
P : Are there any difficulties in making mathematical models?
SV : None
P : What are the steps you take to interpret the results you have obtained on the questions?
SV : This SPLTV material has been taught by a mathematics teacher during semester 1, to work on it I look back at my notes. I did it using the blending method until I got the results
P : Why do you use the mixed method?
SV : Because I am used to using mixed methods and I feel confused if I only use one of the methods
P : Do you have any difficulties in solving problems?
SV : No difficulty
P : After you solve the problem, how do you make sure that the results you get are correct?
SV : To make sure, I do a substitution method on the result I get to one of the equations
P : How do you draw conclusions after solving the problem?
SV : I conclude by reflecting on the completion steps I have worked on and reviewing the results of each variable before drawing conclusions.

Analysis of Numeracy Literacy Ability Test and Interview on Auditory Subjects

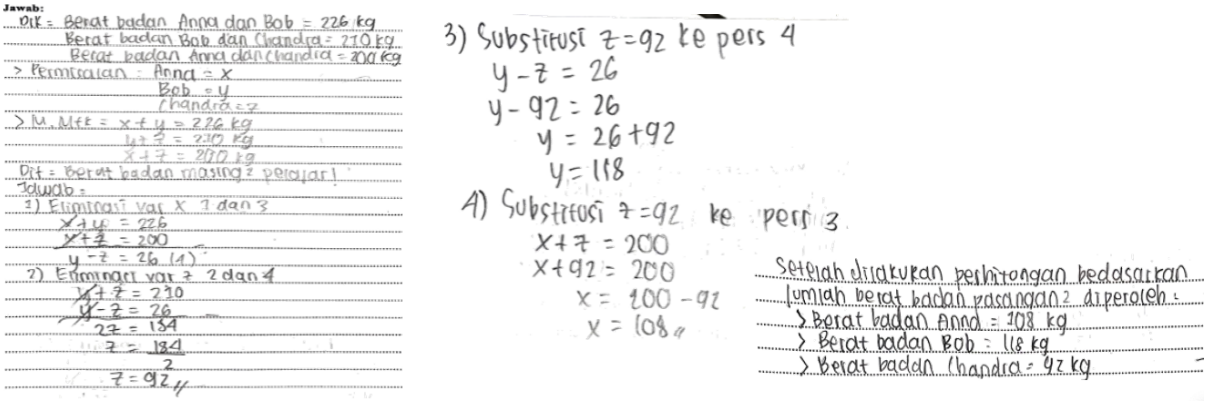

Figure 3. Auditory Subject Answers

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Jurnal Penelitian dan Pengembangan Pendidikan
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Vol. 12 No. 3 : July 2025
E-ISSN: 2722-4627
pp. 866-875

Figure 3, In the question, SA is able to write record the details that are already known and requested in the question appropriately according to the first indicator of numeracy literacy ability. In addition, SA is able to write numbers and symbols into mathematical models correctly to solve problems in the problem according to the second indicator of numerical literacy proficiency. SA is able to interpret the results and write conclusions appropriately according to the three indicators of numeracy literacy ability.

The subsequent details outline the outcomes of the researcher's conversation with the participant:

P : How do you understand the question and write the information on the question?
SA: I understand the problem first, then I write down what information is known and asked in the question, make examples such as x, y, z, and make a mathematical model based on the information in the problem
P : Why do you use the variables x, y, and z to make an example of a problem?
SA: Because I'm used to using the variables x, y, and z for examples
P : Are there any difficulties in understanding and writing down the information in the question?
SA : No difficulty
P : How do you translate the information in the problem into a mathematical model?
SA: I note the information that is provided in the issue, make an example and then make a mathematical model
P : Are there any difficulties in making mathematical models?
SA: In the question I find it difficult to include variables in the mathematical model
P : What are the steps you take to interpret the results you have obtained on the questions?
SA: I read and understand the questions, look for what information is known in the problem, write down the exemplary variables, make mathematical models, write what information is asked in the question, work on the problem with mixed methods
P : Why do you use the mixed method?
SA : The mixed method is an easier and simpler method to solve the problem in the SPLTV problem, eliminating one variable after which we can substitute the variable from the other equation.
P : Do you have any difficulties in solving problems?
SA: After I reread the question, then got the information I knew about the question, I didn't find it difficult
P : After you solve the problem, how do you make sure that the results you get are correct?
SA : I double-checked and recalculated my work results
P : How do you draw conclusions after solving the problem?
SA : The way I draw up the conclusion, I see and write down the results of what I have already obtained

Analysis of Numeracy Literacy Ability Test and Interview on Kinesthetic Subjects

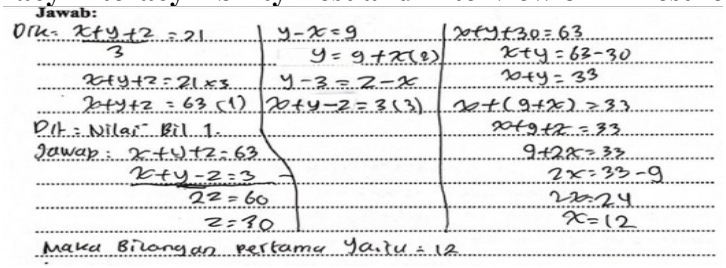

Figure 4. Kinesthetic Subject Answers

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Jurnal Penelitian dan Pengembangan Pendidikan
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Vol. 12 No. 3 : July 2025
E-ISSN: 2722-4627
pp. 866-875

Figure 4, In the question, the SK has not been able to write record the details that are already known and requested in the question, so it is not in accordance with the indicator of an individual's numeracy and literacy skill. In addition, SK is able to write numbers and symbols into the mathematical model correctly to solve problems in the problem according to the second indicator of numerical literacy proficiency. SK is also able to interpret the results and make conclusions appropriately to meet the 3 indicators of numeracy literacy ability.

The subsequent details outline the outcomes of the researcher's conversation with the participant:

P : How do you understand the question and write the information on the question?
SK: First I read the problem carefully, after that I write down the examples of the information in the problem and make the equations into a mathematical model
P : Are there any difficulties in understanding and writing down the information in the question?
SK : Don't find it difficult
P : How do you translate the information in the question into a mathematical model?
SK : I make a mathematical model according to the example I have written
P : Are there any difficulties in making mathematical models?
SK : I don't find it difficult because I understand the problem
P : Why do you use the variables x, y, and z?
SK : I suppose the variables are in the order of the problem and the alphabet
P : What are the steps you take to interpret the results you have obtained on the questions?
SK: As the first step, I read the question, made an example, made a mathematical model, after writing down the infromation I immediately worked on it with the method that I could and had been taught by the teacher, namely the mixed method
P : Why do you use mixed methods in solving problems?
SK: In my opinion, it is easier to use mixed methods, than just using one of the methods
P : Do you have any difficulties in solving problems?
SK: I find it difficult in the process of solving it because I have not been taught such a model of questions
P : After you solve the problem, how do you make sure that the results you get are correct?
SK: To ensure whether the results are correct, I usually use the substitution method, which is to enter the values of the variables according to the questions

Students with visual learning styles as a whole showed quite good ability to apply numeracy literacy skills to the aspect of mathematical modeling and make conclusions. However, it still needs to be improved in writing the information contained in the questions. Visual learners are able to understand positions, shapes, and numbers regularly and are able to remember the material delivered in writing, but are not able to convey information on the questions in the form of narratives or written descriptions correctly. In line with the results of the research (Anjariyah et al., 2025) the subject is able to use numbers and symbols appropriately and then perform calculations using the right formula and is able to find the exact calculation results.

Students with an overall auditory learning style show good ability to solve problems, starting from understanding information, making mathematical models, to making the right conclusions. Auditory students are able to learn through listening both in activities, verbal and discussion methods well, and solve problem problems with the right steps after listening to explanations from educators. In line with the results of the research (Anjariyah et al., 2025)

Vol. 12 No. 3 : July 2025
E-ISSN: 2722-4627
pp. 866-875

the subject is able to understand and explain the results of the analysis well, able to express the results of the calculation by making the right conclusions.

Students with an overall kinesthetic learning style show a fairly good ability to interpret results and infer results. However, it still needs to be improved in terms of writing information on the questions. Kinesthetic students are able to understand learning through physical movements or using teaching aids and like learning by playing well, but have difficulty in writing down information in the form of written descriptions appropriately. In line with the results of the research (Anjariyah et al., 2025) the subject is able to use numbers and symbols appropriately, are able to analyze information practically, write down formulas that are used directly, and explain results by interpreting results more practically and precisely.

Based on the results of the above analysis, overall students with auditory learning styles are better at applying numeracy literacy skills than students with visual and kinesthetic learning styles. It can be shown based on the results of the analysis of numeracy literacy indicators achieved by auditory subjects such as the ability of students to understand the information in the question, make mathematical models appropriately, interpret and make conclusions appropriately. These findings are reinforced by the results of the study (Yerizon et al., 2023) which shows that students with auditory learning styles tend to have better numeracy literacy skills compared to students with visual and kinesthetic learning styles.

Educators are advised to recognize and understand the learning style of each student so that they can implement appropriate learning strategies. With diverse approaches such as: visualization, discussion, physical activity can increase the effectiveness of learning. In addition, the researcher then needs to consider other factors that can affect numeracy literacy skills, such as: basic mathematics skills, learning interests, students' experiences and backgrounds. By considering these factors, the learning approach can be adjusted so that students' learning outcomes in the aspect of numeracy literacy skills can be gradually improved.

Conclusion

According to the findings of the analysis of the numeracy literacy ability test and interviews, it can be concluded that each student's learning style has its own advantages in applying numeracy literacy skills. Generally, students are able to understand problems, create mathematical models, and apply concepts to daily life. But some students experience difficulties in questions that are in the form of problems in questions that are not usually encountered or taught by educators. Students prefer to use mixed methods because they are more flexible and easy to understand. However, overall, auditory learning styles have proven to be more effective in supporting the achievement of numeracy literacy abilities in relation to visual and kinesthetic learning preferences.

Recommendation

Based on the findings that have been presented, it is recommended to educators to better understand the learning style of each student. By recognizing the learning styles that students have, educators can adjust the learning strategies used to make them more effective and fun. These adjustments allow educators to provide a variety of questions, including contextual questions relevant to daily life, to train and improve students' numeracy literacy skills.

Vol. 12 No. 3 : July 2025
E-ISSN: 2722-4627
pp. 866-875

In addition, the learning process is expected to focus not only on the delivery of material, but also on efforts to create a learning atmosphere that encourages active participation and interest of students. An approach that is in accordance with learning styles will have a positive impact on students' understanding and achievement in mathematics learning that requires numeracy literacy skills.

For future researchers, the results of this study can be used as a reference to develop a more in-depth study on the influence of certain learning methods or approaches on improving numeracy literacy skills based on students' learning styles. Further research is also recommended to involve more students from various backgrounds, so that the scope of research results becomes wider. Thus, the results of the research can make a greater contribution to the development of adaptive and student-centered learning strategies.

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