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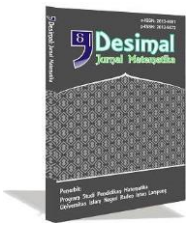

Analysis of students' mathematical literacy ability in solving hots questions in view of learning style

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ABSTRACT

Mathematical literacy is a person's ability to formulate, use and interpret mathematics. The purpose of the study in this article is to analyze students' mathematical literacy in solving HOTS questions about SPLDV materials based on students' learning styles. This type of research is qualitative ethnography. The subject of the study, eighth grade students of SMP Negeri 2 Karanganyar. Data collection techniques are observation, interview and documentation. Validity of data, triangulation of sources and methods. Data analysis techniques, flow methods. This research uses six basic skills of mathematical literacy, namely communication skills, mathematization, representation, determining problem-solving strategies, using operational language and symbols, formal language and technical language, as well as reasoning and giving reasons. The results of the study show that visual learning style students can use six basic mathematical literacy skills in solving HOTS questions in SPLDV, kinesthetic learning style students can use 5 basic mathematical literacy skills in solving HOTS questions in SPLDV. level, and students who have a kinesthetic learning style can use the 5 basic skills of mathematical literacy in solving SPLDV level HOTS questions.

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INTRODUCTION

The challenges faced by students in 21st century learning are increasingly complex (Pramujiyanti Khotimah et al., 2021). This proves that in the field of mathematics, learning is not limited to the calculation process only. According to (Rahayuningsih & Jayanti, 2019) problem solving is one of the main aspects in the mathematics curriculum that occurs not only in Indonesia but also around the world. So at this time students are required to be able to think logically and critically in solving various mathematical problems. Therefore, it is necessary to develop students' mathematical abilities. Mathematical literacy supports an individual in understanding the function or use of mathematics in everyday life,

making the right decision or agreement as a dignified individual, and thinking logically (Syazali et al., 2022). The importance of mathematical literacy is a must-have development. . for students. Mathematical literacy is also one of the student competencies that is an international issue (Astuti & Jailani, 2021). The Ministry of Education and Culture of The Ministry of Education and Culture of the Republic of Indonesia designed a literacy program in basic education to provide human resources for the 21st century (Siahaan, 2018)

Mathematical literacy is a basic ability required by students in 21st century elementary schools (Ginanjar & Widayanti, 2019). According to (Hidayat et al., 2019) mathematical literacy is a person's ability to formulate, use and interpret mathematics. Mathematical literacy ability is the ability measured in the PISA (programme for international student assessment) assessment. There are 4 mathematical contents in PISA, including: change and relationships, space and shape (space and shape), number (quantity), and uncertainty and data (uncertainty and data). Mathematical literacy helps a person recognize the function of mathematics in the world and helps him make the judgments and decisions needed to be a constructive, engaged and reflective citizen (OECD, 2023). With mathematical literacy, a person can have the ability to recognize and use mathematical functions or applications in everyday life. Improving good mathematical literacy skills can improve human resources (Masjaya & Wardono, 2018), such as having more systematic, analytical and critical thinking skills in making the right decisions (Miftakhul Khasanah & Muhammad Abduh, 2023).

(Abidin et al., 2021) proposed seven main abilities that are the basis of mathematical literacy, namely: 1) communication, 2) mathematization, 3) representation, 4) reasoning and giving reasons, 5) problem solving strategies, 6) use operational language and symbols, formal language, and technical language, as well as, 7) the use of mathematical tools. In this research, there are five basic abilities in mathematical literacy used by the researcher, namely: 1) communication, 2) mathematics, 3) reasoning and giving reasons, 4) problem solving strategies, and 5) the use of operations and symbolic language, formal language, and technical language.

Based on the results of PISA 2022, the average mathematics score of Indonesian students experienced a decrease in points compared to 2018, from 379 to 366. At least only 18% of Indonesian students reached level 2 in mathematics, much lower than the OECD average of OECD countries: 69% (OECD, 2023).

Students' mathematical literacy skills can be improved by training students to solve HOTS type questions. Thinking like this requires students to remember, understand, and even solve difficult problems. This is in line with (Errichelli et al., 2017) who states that KT requires the ability to connect, manipulate and change existing knowledge or experience critically and creatively in new situations. Students are trained to think at the level of analysis, evaluation and creation in HOTS questions (Suryapuspitarini et al., 2018). One of the materials suitable for training mathematical literacy skills among primary school students is the System of Linear Equations in Two Variables (SPLDV). In this material there is a story problem that requires students to formulate mathematical sentences in order to match the researcher's expectations to relate SPLDV materials based on HOTS with students' mathematical literacy abilities. As shown by (Herliani et al., 2023), t he lack of familiarity with teachers related to

mathematical literacy issues causes students to experience difficulties and causes their learning achievements to be weak. According to (Nurhayati & Subekti, 2017), students' learning style is one of the factors that can influence their mathematical representation abilities. The results of the study (Rahmatika et al., 2022) show that visual, auditorial and kinesthetic learning styles vary in the ability to solve mathematical problems. Students who learn according to their learning style will more easily understand the content of the lesson resulting in increased learning achievement.

Based on the explanation above, researchers are encouraged to analyze critical, logical, reasoning and systematic thinking skills in working on HOTS SPLDV questions as well as the influence of learning styles in learning mathematics.

METHOD

This research is a qualitative ethnography. According to (Sulistyaningrum et al., 2021) this research is a research method used to study and describe a phenomenon in depth, complex, focusing on understanding the meaning, interpretation and social context of data. Ethnographic research is an attempt to interpret an action from an event that happened to students that we want to understand systematically (Setiawan et al., 2019). The place of this research is SMP Negeri 2 Karanganyar. The subjects of this study are class VIII-D students. Class selection is based on the recommendation of the mathematics subject teacher. The research procedure can be seen in figure 1.

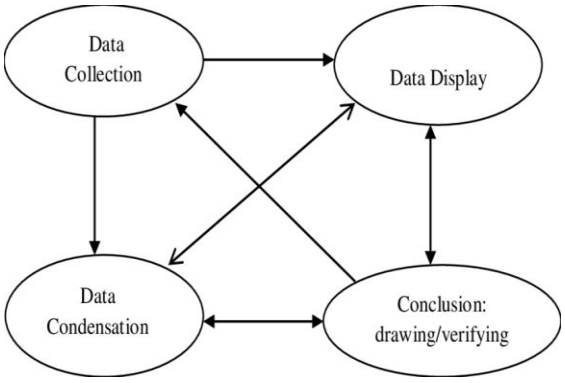

Figure 1. Qualitative Research Stages

Consideration that class VIII-D students have a higher level of literacy than other classes. The question instrument is in Table 1 below.

Table 1. The Question Instrument

Question Items	Question
1	In the math olympiad, the final score is determined by the rule of score 4 for a correct answer, score -2 for a wrong answer, and score -1 for an unanswered question. Out of 60 questions given, Zaky answered 57 questions and got a score of 129. How many questions did Zaky answer wrong?
2	An architect wants to make a rectangular swimming pool that is one-third as wide as it is long. If the circumference of the pool is 48 meters. So the land surface area required to build a swimming pool is

Data collection techniques in the study use learning style questionnaires, mathematical literacy tests and interviews. A learning style questionnaire is used to find the learning style of each student. Test techniques to assess students' mathematical literacy skills with SPLDV materials. Interviews are used to strengthen the students' answers in working on the problems that have been given by the researcher.

Mathematical literacy tests were given to all subjects, but interviews were conducted with 3 subjects who had high mathematical literacy skills with visual, auditory and kinesthetic learning styles. After the subjects worked on the literacy questions, analysis of the results of the

math literacy test was conducted based on the indicators of math literacy abilities as shown in Table 2.

Table 2. Indicators of math literacy

Indicator	Description
Communication	Students can understand and write down the information in the question
Mathematization	Students can represent the context of the problem to a mathematical model.
Representation	Students can interpret the representation form to solve the problem in the question.
Designing strategies to solve problems	Students can determine strategies and explain steps to solve problems.
Use of symbolic, formal and technical operations and language	Students can use arithmetic operations and use mathematical language appropriately.
Reasoning and giving reasons	Students can draw conclusions about the problem.

Mathematical literacy skills can be measured using test instruments, learning style questionnaires and interviews. The test instrument is in the form of 2 essay questions in the form of HOTS on SPLDV materials that are compatible with mathematical literacy indicators. The learning style questionnaire instrument contains 33 expressions with 11 related to visual learning style, 11 expressions related to auditory learning style and 11 expressions related to kinesthetic learning style. The interview instrument was conducted with 3 students consisting of students with a visual learning style, students with an auditory learning style and students with a kinesthetic learning style. Three students were selected based on the learning style obtained from the test results that scored the highest. Data validity is carried out by technical triangulation, data triangulation and source triangulation (Sutama, 2019). The researcher used the triangulation technique. The triangulation technique in this research is comparing data from the math literacy test with interviews. The data analysis technique in this research has 3 ways of analyzing data, namely reduction, data presentation and drawing conclusions (Sutama, 2019). The reduction of data in this research is focused on research related to mathematical literacy abilities in working with HOTS-based problems in terms of learning style. Data presentation is a written description of the data obtained from the interview results so that the data is clearly organized. So that the presentation of the data obtained can provide the possibility to draw conclusions. Then the conclusion is made by looking at the results of the mathematical literacy ability test by interviewing the study subjects.

RESULTS AND DISCUSSION

The math literacy test consists of 2 essay questions in the form of HOTS on SPLDV materials. This test is distributed by students and then analyzed from the work of students who have auditory, visual and kinesthetic learning styles.

The results of the learning style test show that 15 students have an auditory learning style, 6 students have a visual learning style and 3 students have a kinesthetic learning style. The research subjects examined in this study are presented in Table 3.

Three subjects with high math literacy test results were interviewed. Interviews were conducted to reinforce

student answers in working on literacy test questions. The results of the analysis of mathematical literacy tests and interviews based on mathematical indicators can be seen in Table 4.

Table 3. Research Subjects Based on Student Learning Styles

Subject Code	Learning Style
V1	Visual
A1	auditory
K1	kinesthetic

Table 4. Results of analysis of mathematical literacy tests and interviews

Indikator Literasi	Number 1			Number 2		
	V1	A1	K1	V1	A1	K1
Communication	√	√	√	√	√	√
Mathematization	√		√	√	√	√
Representation	√	√	√	√	√	√
Designing strategies to solve problems	√	√	√	√	√	√
Use of symbolic, formal and technical operations and language	√	√		√	√	√
Reasoning and giving reasons	√			√		

Based on Table 4, all subjects in solving the test questions can meet two indicators of mathematical literacy ability, namely the subject can write the information in the question and can determine the design strategy. In question number 1, subject V1 can meet 6 indicators of mathematical literacy ability. Subject A1 can meet 4 indicators of mathematical literacy ability. K1 subjects can fulfill 4 mathematical literacy abilities. In question number 2, subject V1 can meet 6 indicators of mathematical literacy ability. Subject A1 can meet 4 indicators of mathematical literacy ability. K1 subjects can fulfill 5 mathematical literacy abilities. Here is an analysis of student answers.

1. Analysis of answers to students' mathematical literacy abilities with a visual learning style

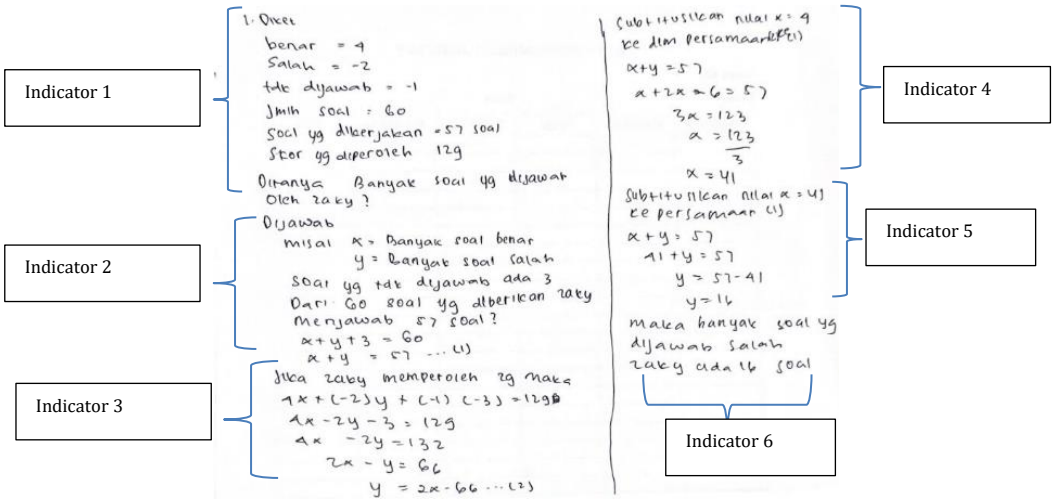

Figure 1. SV student answer number 1

Based on Figure 1, it can be analyzed in detail based on indicators of mathematical literacy abilities. In indicator 1, SV is able to communicate problems by understanding and knowing the information that is known and asked. In indicator 2, SV is able to change problems into mathematical form. In indicator 3, SV is able to restate mathematical problems. In indicator 4, SV is able to choose a strategy to solve the problem. In indicator 5, SV is able to use mathematical symbols and technical language well. In indicator 6, SV is able to provide arguments for the reasoning and reasons for the answers to the questions.

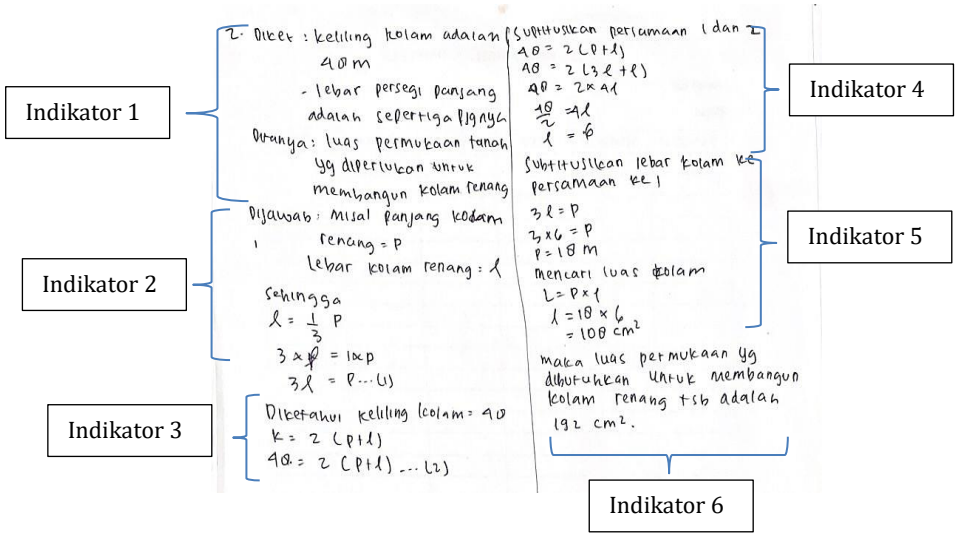

Figure 2. SV student answer number 2

Based on Figure 2, it can be analyzed in detail based on indicators of mathematical literacy abilities. In indicator 1, SV is able to convey the problem by understanding and knowing the information that is known and asked. In indicator 2, SV is able to convert problems into mathematical form. In indicator 3, SV was able to restate the mathematical problem. In indicator 4, SV can choose a strategy to solve the problem. In indicator 5, SV can use mathematical symbols and technical language well. In indicator 6, SV can provide arguments for reasons and reasons for answers to questions.

2. Analysis of answers to students' mathematical literacy abilities with an auditory learning style

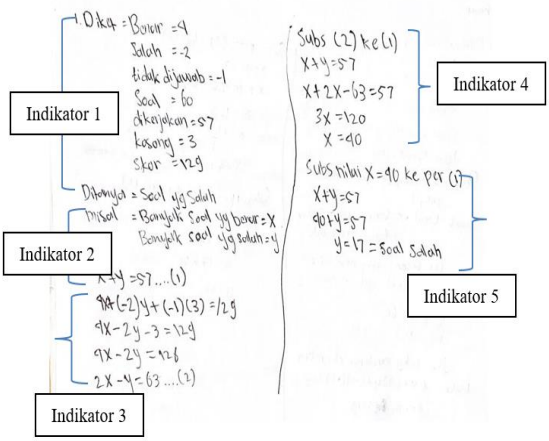

Figure 3. SA student answer number 1

Based on Figure 3, it can be analyzed in detail based on indicators of mathematical literacy abilities. In indicator 1, the SA can communicate the problem by understanding and knowing the information that is known and asked. In indicator 2, SA is able to transform problems into mathematical form. In indicator 3, the SA was unable to restate the math problem. This is evidenced by SA not writing equation 2. In indicator 4, SA

can choose a strategy to solve the problem. In indicator 5, SA is able to use symbolic language and operations. This is evidenced in Figure 3. In clue 6, SA is unable to provide arguments for reasons and reasons for answers to questions. This can be seen from the results of the researcher's interview with the research subject that A1 could not describe the known problems in the problem before determining the solution. A1 could not explain the conclusion obtained from this problem.

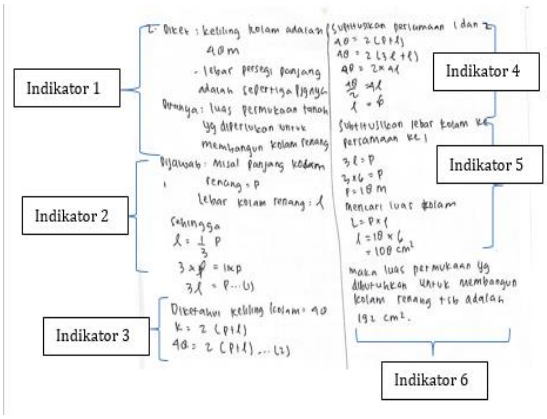

Figure 4. SA student answer number 2

Based on Figure 4, it can be analyzed basically based on indicators of mathematical literacy abilities. In indicator 1, the SA can communicate the problem by understanding and knowing the information that is known and asked. In indicator 2, SA was unable to convert the problem into mathematical form. However, SA did not write a mathematical model that matched what was known about the problem. SA can assume x with many correct questions and y with many wrong questions. Then change the problem to equation 1. However, another equation by SA has not been written. In indicator 3, SA was able to restate a mathematical problem. In indicator 4, the SA can choose a strategy to solve the problem. In indicator 5, SA is able to use symbolic language and operations. This is evidenced in Figure 4. In clue 6, SA is unable to provide arguments for reasons and reasons for answers to questions. This can be seen from the results of the researcher's interview with the research subject that A1 could not present the problem in the form of a simpler mathematical model. A1 could not explain the conclusion obtained from this problem.

3. Analysis of answers to students' mathematical literacy abilities with a kinesthetic learning style

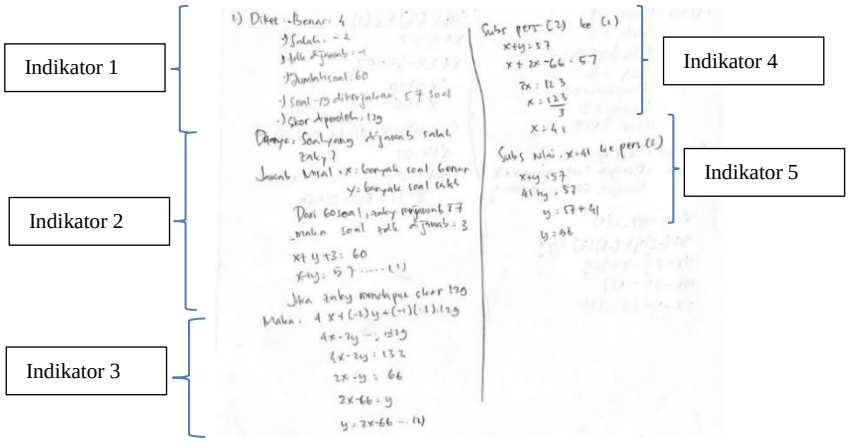

Figure 5. Students' answers to SK number 1

Based on Figure 5, it can be analyzed in detail based on indicators of mathematical literacy abilities. In indicator 1, SK can convey the problem by understanding and knowing the information that is known and asked. In indicator 2, SK is able to transform problems into mathematical form. In clue 3, SK was able to restate the math problem. In indicator 4, SK can choose a strategy to solve the problem. In indicator 5, SK has not been able to use

mathematical symbols and technical language well. This is proven by SK that the symbolic operation is wrong according to the problem that has been given based on mathematical definitions and rules. In indicator 6, SK has not been able to provide the arguments above the reasons and reasons to answer the question. SK did not write the final conclusion in the answer.

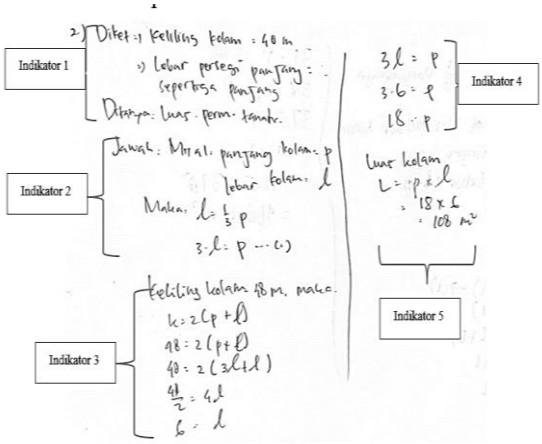

Figure 6. Student answers to SK number 2

Based on Figure 6, it can be analyzed in detail based on indicators of mathematical literacy abilities. In indicator 1, SK can convey the problem by understanding and knowing the information that is known and asked. In indicator 2, SK is able to transform problems into mathematical form. SK writes a mathematical model that matches what is known about the problem. In clue 3, SK was able to restate the math problem. SK can connect different types of representation when solving problems. In indicator 4, SK can choose a strategy to solve the problem. This is evident by the strategy chosen by SK through various procedures that lead to solutions and conclusions from solving problems. In indicator 6, SK has not been able to provide arguments for the reasons and reasons for the answer to the question. SK does not write conclusions from various mathematical arguments based on the results of solving problems that have been given.

The results of this research are in line with research conducted by (Fuadi, S et al., 2021) which shows that the visual learning style of students dominates the results of the study, which is that 38% of students have a visual learning style, which is 25% of students have an auditory learning style, and 27 % of students with a kinesthetic learning style. Students who have a visual learning style tend to get higher scores in HOTS questions on SPLDV material compared to students who have an auditory and kinesthetic learning style. In research (Saputri, A. I., & Khotimah, 2020) said that students with high mathematical literacy skills can master the skills of writing information, apply concepts, procedures, facts and reasoning, be able to interpret and evaluate results and be able to explain answers. Students with a visual learning style meet all indicators of mathematical literacy ability. This agrees with the study that the dominant student learning style is visual (Bahri et al., 2023). Subject V1 can give any information about problems, able to formulate mathematical models from everyday sentences, can explain the steps of solving questions, can use operations, symbolic language and variables and can give conclusions and prove answers correctly. This is similar to research (Sari et al., 2023) which states that students who have a visual learning style tend to be able to solve math problems coherently. Students who have an auditory and visual learning style get better math literacy results than students who have a kinesthetic learning style (Trisnaningtyas & Khotimah, 2022). Students who have a kinesthetic learning style can meet several indicators of mathematical literacy abilities. Subject K1 can provide information about problems and can formulate mathematical models. However, they cannot use solution methods and cannot provide conclusions and prove answers. This is similar to research (Yerimadesi et al., 2019) that students with a kinesthetic learning style cannot produce results and cannot re-evaluate

the strategies used in working on questions. Students with an auditory learning style tend to only be able to absorb information through hearing, so they have difficulty creating a picture of a problem. This is proven by the study of DePoter and Hernacki who stated that the auditory learning style tends to understand and remember information or knowledge by relying on hearing. Through the cases obtained, teachers are expected to be able to provide more HOTS question exercises in various other contexts to train students to improve mathematical literacy skills for students with low mathematical literacy skills and maintain mathematical literacy skills for students with high literacy skills.

CONCLUSIONS AND SUGGESTIONS

Based on the explanation above, it can be concluded that the mathematical literacy abilities of students who have a visual learning style are more dominant than those who have an auditory and kinesthetic learning style. Subject V1 can meet all indicators of mathematical literacy abilities. students with auditory and kinesthetic learning styles only meet some indicators of mathematical literacy abilities. Therefore, students with a visual learning style have high mathematical literacy abilities.

It is recommended for future research to develop and test more HOTS questions that may be able to accommodate individual learning styles, and evaluate their effectiveness in improving students' literacy and numeracy skills.

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