



Analysis of Mathematical Literacy Ability of Students in terms of Visual Learning Styles and Gender Differences

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Abstract

The aim of this study was to determine the mathematical literacy skills of grade VIII students (male and female) based on visual learning styles at SMP Negeri (State Middle School) 2 Kendari. This study used an exploratory method with a qualitative approach. Results of the study indicated that: (1) as seen from solving problems related to quantity content aspect, female students with a visual learning style had not been able to pass the stage of using mathematical tools; on space and shape content aspect they were able to pass all stages; meanwhile on change and relationships content aspect the female students were also able to pass all stages. (2) seen from quantity content aspect to solve problem, male students with a visual learning style had not been able to pass the stages of formulating and planning strategies as well as using mathematical tools; on space and shape content aspect they were able to pass all stages; and on change and relationship content aspect, the male students were able to pass all stages. Female students with visual learning styles have not been able to go through one stage, namely the stage of using mathematical tools. While male students with a visual learning style have not gone through two stages, namely the stage of formulating and planning strategies then the stage of using mathematical tools.

Keywords: *Literacy Skills, Visual Learning Styles, Gender*

A. Introduction

Mathematics is a field of study tested as the object of study in the PISA (Program for International Students Assessment). Assessment in mathematics is not only limited to learning

outcomes, but also examines one of the abilities contained in the learning curriculum plan known as mathematical literacy. Mathematical literacy helps someone to understand the role or use of mathematics in everyday life as well as to use it to make the right decisions as a citizen who builds, cares and thinks. According to (Anisah, Z., Zulkardi, Z., Darmawijoyo, 2011) a person is considered to have a level of mathematical literacy if he is able to analyze, reason and communicate his mathematical knowledge and skills effectively, and is able to solve and interpret mathematical problems in various situations related to.

PISA (Program for International Students Assessment) survey has been conducted since 2000 and held every 3 years. Indonesia always participates in this survey activities conducted by PISA Governing Body. Based on the 2015 PISA, Indonesia is included in the 10 countries with low literacy skills, namely in the 69th position out of 76 countries (Pisa, 2016). The average score of Indonesian students' mathematical literacy skills is 375 (level 1), while the average score at the international level is 500 (level 3). Level 1 is the lowest level of the 6 literacy skills applied by PISA. Mathematical literacy has not received more attention. Some abilities in mathematics need to get more in depth study, including methemathical literacy abilities (Aydin^a, Uysal, & Sarier, 2010) As seen in the results of several areas on mathematical literacy outcomes shown that Kendari City has very low mathematical literacy with a percentage of 19.4% compared to other cities (Maulana, A. 2016) In addition, the students are unable to create mathematical models from the questions given, thus the students are unable to solve problems appropriately (Maulana and Hasnawati, 2016: 14). This fact indicates the low mathematical literacy skills of the students. This condition suggests that the ability of mathematical literacy or the ability to refer to indicators of formulating, applying and interpreting mathematics in various contexts is still low (Ismael, 2012)

Study by (Rahmawati & Penelitian, 2014) found that there are 3 factors affecting the achievement of mathematics literacy in Indonesia, including personal factors, instructional factors and environmental factors. The results of the above study did not analyze one of the factors that contributed to the achievement of students' mathematics learning outcomes, namely learning styles. Learning style is a person's ability to absorb, understand, and then manage the knowledge or information obtained to bring off better achievement and learning outcomes as well as improve the quality of education. Each student has their own uniqueness, especially in the learning process. One of these uniqueness is the way students learn or what is usually called the student learning style. Most students learn in a variety of styles, but in fact one style is more dominant than the other. (Said., 2003) reveal that learning styles are a combination of the way a person absorbs, organizes, and processes information. This is in line with the (Pendidikan, 2007) which defines learning styles as the best way for a person to get information.

Apart from learning styles, it turns out that gender is also a factor influencing individuals to understand and acquire mathematical knowledge. Mitsos and Browne (Haralambos, Holborn, Heald, & Trowler, 2004) stated that women have a higher result of learning outcomes or achievement than men. It can be due to women are more resilient, more motivated, more diligent and persistent in doing task or school assignments. Women with high organizational skills and motivation offer an advantage in work that counts towards further assesment than their capabilities. (Geary, Sauls, Liu, & Hoard, 2000) stated that men have better spatial skills, calculation skills, and arithmetic reasoning compare to women. According to the American Psychological Association (Amir., 2013) the capability of men to complete work in the field of mathematics has no major difference from the ability of women.

One of the teachers at SMP Negeri (State Middle School) 2 Kendari stated that no one had ever examined literacy skills in the school and based on a preliminary study conducted by the studyers concluded that in general students were not able to construct and communicate explanations and arguments in the problem context and students was incapable to decide and planning strategies to form contextual problems. The results of the study above indicated that students 'mathematical literacy skills are still low, although the information on students'

mathematical literacy abilities is essential, since the information regarding these abilities can be used as one of the bases to improve and

prepare the schools and the students to implement 2013 curriculum properly.

Furthermore, the teacher also stated that male and female students had different learning styles in understanding the material in class and the students had higher interest and enthusiasm in mathematics lessons when the teacher utilized interesting pictures to explain material. This situation attracts the attention of studyers to conduct exploratory study regarding students' mathematical literacy abilities in terms of learning styles and gender differences in grade VIII at SMP Negeri (State Middle School) 2 Kendari more deeply in the hope that the information explored will be more concrete and can be used as reference material to solve existing problems in developing students' mathematical literacy.

B. Methodology

1. Research Design

This study is an exploratory study with a qualitative approach. This study used a qualitative approach refers to the five characteristics of qualitative study according to Bogdan and Biklen as follows: (1) Naturalistic in nature, namely study is performed according to actual conditions as the source of data, and the studyer as the main instrument; (2) Descriptive data, namely data collected in the form of a series of words or pictures; (3) Pay close attention to the process, namely the process is put in higher regard than the results; (4) Inductive, which means the study is performed not to prove the formulated hypothesis; and (5) Meaningful, which means this study pays attention to the meaning of each activity because the studyer is directly involved in what the subject does and says (Anggo, 2010: 48). This research was conducted at SMPN 2 Kendari class VIII. The research subject were 2 (two) students obtained from class VIIIB students of SMPN 2 Kendari in the even semester of the 2018/2019 academic year which consisted of 1 (one) male subject and 1 (one) female subject. With the following criteria: (1) students who have one of the learning styles, namely visual learning styles (2) students who are able to communicate ideas or thoughts both orally and in writing.

2. Instruments

The instruments used in this study were a learning style questionnaire to determine the learning styles of the students, and a student's mathematical literacy test instrument to obtain the data of the students' mathematical literacy abilities.

3. Technique of Data Analysis

The analysis in this study followed Miles and Huberman's analysis model (in Sugiyono: 341), namely the processes of (1) data reduction (2) data display and (3) conclusion drawing.

C. Findings and Discussion

1. Findings

This section described and discussed the data obtained from each subject regarding the problems in chapter 1, namely a description of students' mathematical literacy abilities in terms of visual learning styles and gender differences. This study was supported by a learning style questionnaire, question instruments and interview guides to reveal students' mathematical literacy abilities in terms of visual learning styles and gender differences including preparation, data collection and data analysis.

The literacy ability test instrument given to the students consisted of 3 (three) problems, each of which contained several basic mathematical abilities corresponding to the three problem-solving processes in mathematical literacy, namely communication, mathematics, representation, formulating and planning strategies; use of symbols, formal language, techniques; as well as use of operations and mathematical tools.

a. Female Students Mathematical Literacy Skills with Visual Learning Styles (S1VP)

After being given a questionnaire, the study subjects were given a mathematical literacy test then the answers to the mathematical literacy ability test were analyzed. The criteria for students who were selected as study subjects are: (1) students with visual learning style; (2) students who are able to communicate ideas or thoughts both orally and in writing.

The answers to the female students' mathematical literacy skills test with a visual learning style can be seen in the following figure:

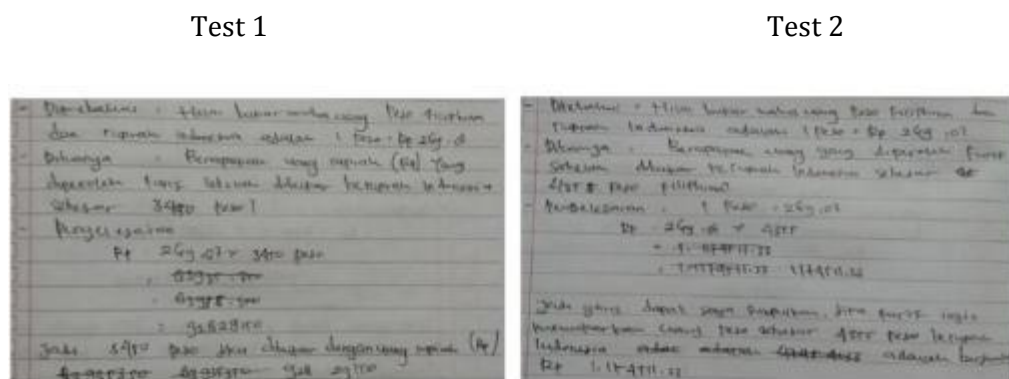


Figure 1. Answers to the Mathematical Literacy Ability Test in Problem Number 1

Problem Number 1 (*Quantity Content*)

Credible data was obtained through solving problem number 1 (one), female students with a visual learning style (S1VP) being assessed with test 1 (one) and test 2 (two). It can be seen that they could write down information given in the problem correctly, namely 1 peso = Rp269,07 and could write important questions from the problem provided, namely how much rupiah Faris obtained after exchanged Indonesian rupiah of 3450 for the test 1 (one) and 4355 peso for the test 2 (two), thus it can be said that (S1VP) can pass *the communication stage in mathematical literacy*. (S1VP) could describe the process of changing real problems into mathematical form, namely when Faris exchanged peso into rupiah (S1VP), then (S1VP) multiplied IDR 269,07 by 3450 for test 1 (one) and multiplied IDR 269,07 by 4355 for test 2 (two), thus (S1VP) can describe the mathematical stage in mathematical literacy. Furthermore, (S1VP) can write and adequately explain the steps to solve the problem, namely the students wrote the formula used, then (S1VP) put the information known from the problem in the formula used in solving the problem, hence (S1VP) could pass the stage of formulating and planning strategies in mathematical literacy. When performing mathematical operations, (S1VP) were unable to provide the correct answer, thus it can be said that (S1VP) are unable to pass the using mathematical tools stage in mathematical literacy.

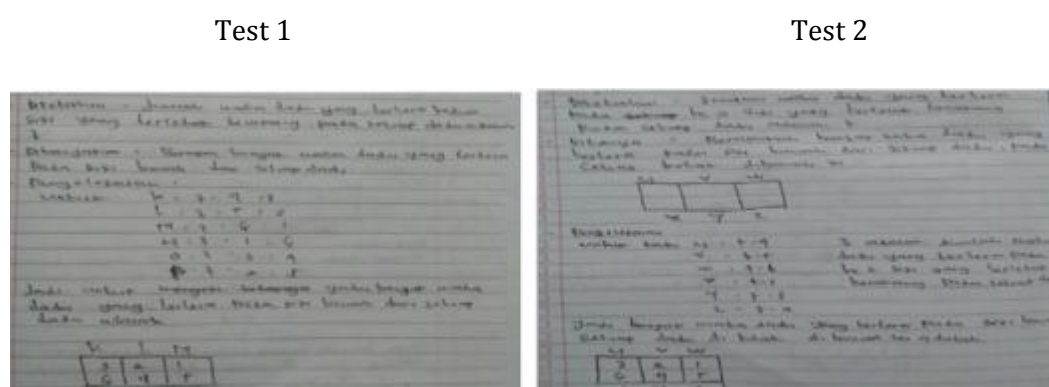


Figure 2. Answers to the Mathematical Literacy Ability Test in Problem Number 2

Problem Number 2 (*Space and Shape Content*)

Through solving problem number 2 (two), female students with a visual learning style (S1VP) were tested with test 1 (one) and test 2 (two), then credible data was obtained, namely they already knew and understood the real problem, this can be seen from (S1VP) could write the information obtained from the question precisely, namely the number of dice listed on the two opposite sides of each dice is 7 (seven) and could write important questions according to the information given, namely the number on bottom side of each dice, thus it can be said that (S1VP) can pass the communication stage in mathematical literacy. (S1VP) can also describe the process of turning real problems into mathematical form, namely when looking at the dice image (S1VP) could change the points on the dice into numerical form according to the number of points on each dice that had been labeled, therefore (S1VP) can pass the mathematics stage in mathematical literacy. Furthermore, (S1VP) could properly write and explain the problem solving steps, namely after the subjects write the formula used, then (S1VP) put the information known from the problem in the formula used in solving the problem, thus (S1VP) can pass the stage of formulating and planning strategies in literacy. When performing the mathematical operations, (S1VP) could provide the correct answer, thus it can be said that (S1VP) can pass the using mathematical tools stage in literacy.

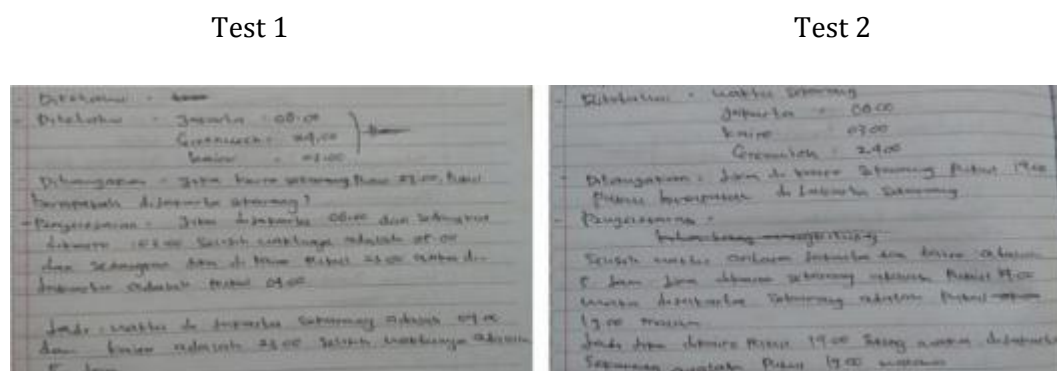


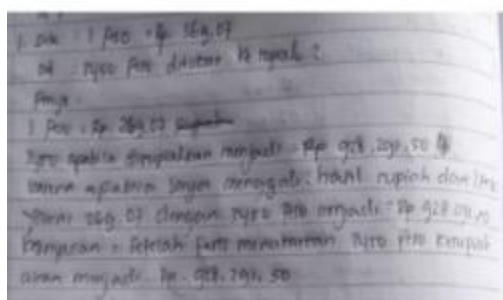
Figure 3. Answers to the Mathematical Literacy Ability Test in Problem Number 3

Problem Number 3 (*Change and Relationships Content*)

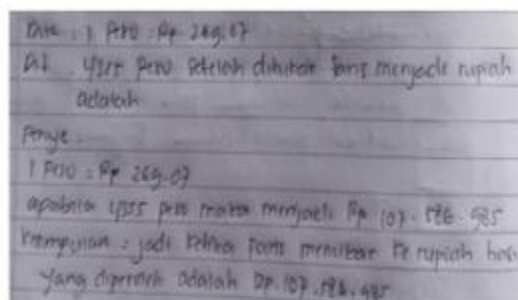
Credible data was obtained through solving problem number 1 (one), female students with a visual learning style (S1VP) being assessed with test 1 (one) and test 2 (two). The results showed that they knew and understood the real problem, this can be seen from (S1VP) could write down the information known in the question accurately, namely the time in Jakarta is 08.00; Cairo is 03.00; Greenwich is 24.00 and find the important questions from the question given, namely for test 1 (one) if in Cairo at 03.00 what time is it in Jakarta now and for test 2 (two) if in Cairo is 14.00 what time is it in Jakarta now, thus it can be said that (S1VP) can pass the communication stage in mathematical literacy. (S1VP) could describe the process of converting real problems into numbers, hence (S1VP) can pass the mathematical stage of mathematical literacy. (S1VP) could represent an object to a mathematical problem in question number 3 (three), thus it can be said that (S1VP) can pass the representation stage in mathematical literacy. Moreover, (S1VP) could write and accurately explain the steps to solve the problem according to their (subject) understanding, namely after (S1VP) write the formula used, (S1VP) enter information gathered from the problem in the formula used in solving the problem, thus (S1VP) can pass the formulating and planning strategies stage in literacy. (S1VP) could understand language and use the numeric symbols on clocks, as well as performing the formal operations. When performing mathematical operations, (S1VP) could write the correct answer, hence it can be said that (S1VP) are unable to pass the using mathematical tools stage in literacy.

b. Male Students' Mathematical Literacy Skills with Visual Learning Styles (S2VL)

Test 1

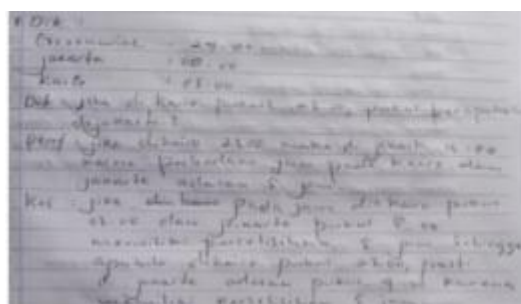


Test 2

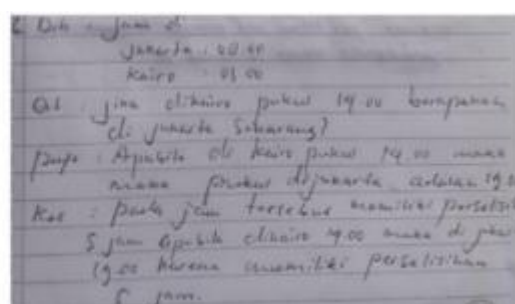
**Figure 4.** Answers to the Mathematical Literacy Ability Test in Problem Number 1Problem Number 1 (*Quantity Content*)

Through solving problem number 1 (one), credible data was obtained from male students with a visual learning style (S2VL) assessed with test 1 (one) and test 2 (two), namely the subject had sufficient knowledge and understood the real problem, this can be seen from (S2VL) could precisely write the known information from the question given, namely 1 peso = Rp. 269,07 and wrote the important questions from problem given, but (S2VL) were unable to write the questions in the correct sentence, namely 4355 peso after being exchanged to rupiah by Faris was, thus it can be said that (S2VL) are unable to pass the communication stage in mathematical literacy. (S2VL) could describe the process of converting real problems into mathematical form, namely when Faris exchanged peso into rupiah (S2VL), he must multiply Rp269,07 by 4355 pesos, hence (S2VL) can pass the mathematical stage of mathematical literacy. In addition, (S2VL) could write but unable to properly explain the problem solving steps, hence this indicates that (S2VL) is unable to pass the formulating and planning strategies stage in mathematical literacy. When performing mathematical operations, (S2VL) were unable to provide the correct answer, thus it can be said that (S2VL) are unable to pass the using mathematical tools stage in mathematical literacy.

Test 1



Test 2

**Figure 5.** Answers to the Mathematical Literacy Ability Test in Problem Number 2Problem Number 2 (*Space and Shape Content*)

Credible data was obtained through solving problem number 1 (one), male students with a visual learning style (S2VP) being assessed with test 1 (one) and test 2 (two). The subject knew and understood the real problem, this can be seen from (S2VL) wrote the known information given in the question correctly, namely the number of dice listed on two opposite sides of each dice is 7 (seven) and the subject can write important questions from the information given,

namely the number of dice on the lower side of each dice, thus it can be said that (S2VL) can pass the communication stage in mathematical literacy. (S2VL) could describe the process of changing real problems into mathematical form, namely when looking at the dice image (S2VL) can change the points on the dice into numeric form according to the number of points on each labeled dice, hence it can be concluded that (S2VL) can pass the mathematical stage mathematical literacy. (S2VL) can represent an object to a mathematical problem in question number 2 (two) by interpreting the number of dots on each dice to a number, thus it can be said that (S2VL) can pass the representation stage in mathematical literacy. In addition, (S2VL) could write and correctly explain the problem solving steps, namely after the students write the formula used in solving the problem, thus (S2VL) can pass the formulating and planning strategies stage in literacy. When performing mathematical operations, (S2VL) could answers correctly, hence it can be said that (S2VL) can pass the using mathematical tools stage in literacy.

Test 1

Test 2

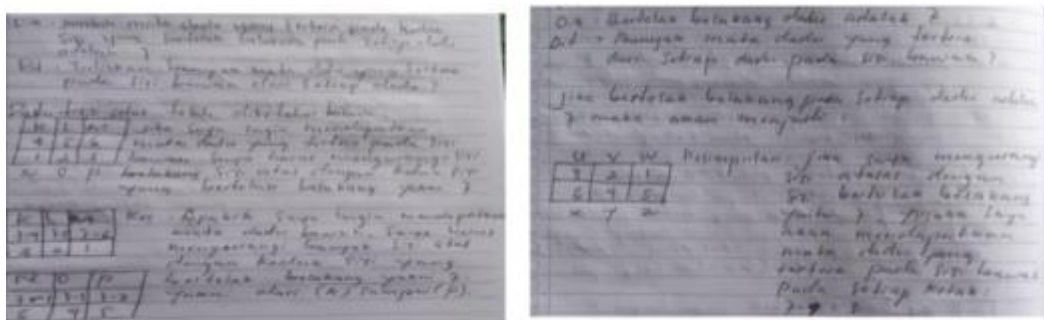


Figure 6. Answers to the Mathematical Literacy Ability Test in Problem Number 3

Problem Number 3 (*Change and Relationships Content*)

Through solving problem number 3 (three), credible data was obtained from male students with a visual learning style (S2VL) assessed by using test 1 (one) and test 2 (two), namely the subject knew and understood well the real problem, this can be seen from (S2VL) wrote the known information given on the question correctly, namely the time in Jakarta is 08.00; in Cairo is 3 am; in Grenwich is 24.00 and find the important questions from the problem given, namely for test 1 (one) if in Cairo is 03.00 what time is it in Jakarta now and for test 2 (two) if in Cairo is 14.00 what time is it in Jakarta now. Hence, it can be said that (S2VL) can pass the communication stage in mathematical literacy. (S2VL) could describe the process of turning real problems into mathematical form, namely when looking at the clock image (S2VL) could interpret the clock into numerical form, thus (S2VL) can be said to be able to pass the mathematical stage in mathematical literacy. Furthermore, (S2VL) could write and correctly explain the problem solving steps, namely (S2VL) write the formula used, then the subjects enter the information provided in the problem in the formula used in solving the problem, thus it can be said that they can pass the formulating and planning strategies stage in literacy. (S2VL) could understand language and use numeric symbols on clocks as well as performing the formal operations. When performing mathematical operations, the subjects could answer correctly, thus it can be said that (S2VL) are able to pass the using mathematical tools stage in literacy.

2. Discussion

Based on the results of literacy tests and interviews, it shows that female students with a visual learning style in the process of solving questions on quantity, space and shape, change and relationships, in general, the subject can model and determine strategies according to information and through the communication stage, mathematical breastfeeding, representasion,

understanding language and use symbols and have not been able to perform formal operations and are able to go through the stage of using mathematical tools in literacy.

Male students with a visual learning style in the process of solving quantity questions have not been able to go through the three basic mathematical abilities, but in the process of solving problems of space and shape, change and relationships in general the subject can model and determine strategies according to information and through the communication, mathematical stages, representation, understand language and use symbols and have not been able to perform formal operations and are able to go through the stages of using mathematical tools in literacy. When the subject is interviewed the subject explains the answer quickly and the subject reads the questions out loud. This is in line with the character of the visual learning style students proposed by De Porter and Hernacki (2003) that students with visual learning styles generally speak quickly.

D. Conclusion

Mathematical literacy skills of female students with visual learning styles seen from quantity content aspect on solving problem showed that the students were able to pass the stages of communication, mathematics, formulate and plan strategies but had not been able to pass the using mathematical tools stage. The data of space and shape content aspect indicated that the male students were able to pass the stages of communication, mathematics, representation, formulate and plan strategies and are able to use mathematical tools. Meanwhile, on change and relationships content aspect, the students were able to pass the stages of communication, mathematics, representation, formulating and plan strategies, understand language, use symbols and perform formal operations and use mathematical tools. The results of content aspects to solve problems given showed that male students' mathematical literacy skills with a visual learning style seen from quantity content aspect had the ability to pass the communication and mathematical stages but have not been able to pass the stages of formulating and planning strategies and using mathematical tools. The data of space and shape content aspect indicated that the male students were able to pass the stages of communication, mathematics, representation, formulate and plan strategies and are able to use mathematical tools. In addition, on change and relationship content aspect showed that male students were able to pass the stages of communication, mathematics, representation, formulate and plan strategies, understand language, use symbols and perform formal operations and use mathematical tools.

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