Prima: Jurnal Pendidikan Matematika
Vol. 8, No. 2, May 2024, pp. 282 - 292
P-ISSN: 2579-9827, E-ISSN: 2580-2216
Web: http://jurnal.umt.ac.id/index.php/prima

ANALYSIS OF MATHEMATICAL LITERACY SKILLS OF STUDENTS IN CLASS VIII SMP NEGERI 3 DAMPELAS IN SOLVING GEOMETRY PROBLEMS IN TERMS OF VAN HIELE LEVEL

Risti Rahmayani [1], Sukayasa[2], Dasa Ismaimuza [3], Welli Meinarni [4]
[1,2,3,4]Department of Mathematics Education, Faculty of Teacher Training and Education, Tadulako University.
Soekarno Hatta Street No.KM. 9, Palu City, Indonesia
e-mail: rahmayaniristi71@gmail.com

Abstract

This research is a descriptive qualitative research that aims to analyze the mathematical literacy skills of SMP Negeri 3 Dampelas students in solving geometry problems in terms of Van Hiele levels. Subjects were selected based on the Van Hiele Geometry Test (VHGT) results by considering the subject teacher's suggestions. Data were collected using tests. The test instrument was prepared based on indicators of mathematical literacy skills and has met the valid criteria. The results of this study show that Van Hiele level 0 thinking subjects can only fulfill 2 indicators of mathematical literacy skills, the subject is able to write the known and asked and can change the problem in the problem. Van Hiele level 1 thinking subjects were able to fulfill 3 indicators of mathematical literacy skills, the subject was able to write down what was known and asked and could relate to the concept of beam area with information from known data to produce a plan to solve the problem using the formula correctly. The level 2 Van Hiele thinking subject was able to fulfill 4 indicators of mathematical literacy skills, the subject was able to write the known and questioned, write the formula to be used correctly, was able to connect with the concept of beam area then apply his knowledge of surface area and provide an explanation of the steps to solve the problem.

Keywords: mathematical literacy, geometry, van hiele

Abstrak

Penelitian ini merupakan penelitian kualitatif deskriptif yang bertujuan untuk menganalisis kemampuan literasi matematika siswa SMP Negeri 3 Dampelas dalam menyelesaikan masalah geometri ditinjau dari level Van Hiele. Subjek dipilih berdasarkan hasil Van Hiele Geometry Tes (VHGT) dengan mempertimbangkan saran guru mata pelajaran. Data dikumpulkan menggunakan tes. Instrumen tes disusun berdasarkan indikator kemampuan literasi matematis dan telah memenuhi kriteria valid. Indikator kemampuan literasi yang digunakan dalam penelitian ini yaitu merumuskan masalah nyata Hasil penelitian ini menunjukkan bahwa subjek level 0 berpikir Van Hiele hanya dapat memenuhi 2 indikator kemampuan literasi matematika, subjek mampu menuliskan yang diketahui dan ditanyakan serta mampu mengubah masalah pada soal ke dalam bentuk matematika. Subjek level 1 berpikir Van Hiele mampu memenuhi 3 indikator kemampuan literasi matematika, subjek mampu menuliskan yang diketahui dan ditanyakan dan mampu menghubungkan dengan konsep luas balok dengan informasi dari data yang diketahui serta membuat suatu rencana untuk menyelesaikan permasalahan menggunakan rumus dengan benar. Subjek level 2 berpikir Van Hiele mampu memenuhi 4 indikator kemampuan literasi matematika, subjek mampu menuliskan yang diketahui dan ditanyakan, menuliskan rumus yang akan digunakan dengan benar, mampu menghubungkan dengan konsep luas balok kemudian menerapkan pengetahuannya tentang luas permukaan serta memberikan penjelasan mengenai langkah-langkah penyelesaian soal.

Kata kunci: kemampuan literasi matematika, geometri, van hiele

INTRODUCTION

In the 21st century, the development of technology and information has changed many things, especially the learning process. In the world of education, mathematics is one

Received: February 8, 2024; Revised: May 15, 2024; Accepted: May 17, 2024

of the most important subjects because mathematics is a branch of science that is often used in various educational sciences (Manalu et al., 2023).

According to the National Council of Teaching of Mathematics (NCTM) in (Maslihah et al., 2020), 5 basic mathematics skills are mathematical problem solving skills, mathematical reasoning skills, mathematical proof, mathematical communication, mathematical connections and representation skills. Based on these five standards, it includes mathematical literacy competencies.

Mathematical literacy is a person's ability to create, apply and understand mathematics in various contexts determined by their abilities (Makhmudah, 2018). (Purwanti et al., 2021) explain mathematical literacy as the ability of individuals to implement mathematics in various contexts in everyday life. Literacy skills are very important for students to have because they can help students use the right methods to solve problems, use mathematics in real life, assess whether the results obtained make sense and analyze situations and draw conclusions (Genc & Erbas, 2019). However, the importance of mathematical literacy is not in line with the quality of education in Indonesia, based on the results of the Program for International Student Assessment (PISA) test organized by the Organization for Economic Coorperation and Development (OECD). From the PISA report, it can be seen that since 2018 Indonesia's ranking in PISA has decreased when compared to the previous 3 years, showing the presentation of student performance in mathematical literacy to be one of the lowest among other countries (Amaliya & Fathurohman, 2022).

Low mathematical literacy skills were also found in students of SMP Negeri 3 Dampelas. Based on the results of interviews with mathematics teachers at SMP Negeri 3 Dampelas. The teacher said that students' literacy skills in geometry material, especially the flat side of the beam which is the main point that must be taught clearly to students, because when students are given math problems students find it difficult to understand between the basic concepts of the flat side of the beam, formulate, interpret the solution and evaluate the problem which causes them difficulty in solving problems in the problem. However, there are one or two students who have good thinking skills in the learning process. From this explanation, it indicates that the low mathematical literacy skills and the level of thinking of students vary, for teachers it is important to know the level of thinking ability of their students so that it can be used as a benchmark in a more conducive and effective learning process. The

results of research conducted (Lestari & Effendi, 2022) are in line with this which shows that the mathematical literacy skills of junior high school students are still below average.

Geometry is one of the most widely studied branches of mathematics in schools, starting from elementary school to college. Geometry is one of the math subjects that must be studied by students in order to develop logical thinking and spatial intuition that is useful for solving everyday problems (Soenarjadi, 2020). Compared to other lessons in mathematics, geometry is one of the lessons that is considered difficult to understand. Students' weak understanding of geometry concepts makes it difficult for students to solve geometry problems, where knowledge of these concepts becomes a fundamental understanding for students to learn more complex geometry material (Khorifah et al., 2022).

Among the various solutions given in solving geometry problems is based on Van Hiele's level of thinking whose results are no doubt. Van Hiele's theory is the right theory to identify students' thinking ability in geometry material. This theory explains the level of understanding of geometry where students cannot reach a level of thinking without going through the previous level, meaning from basic to abstract. Students' geometry thinking level is divided into 5 levels, namely level 0 (visualization), level 1 (analysis), level 2 (informal deduction) and level 4 (rigor) (Rahayu & Jupri, 2021). Junior high school students are between level 0 (visualization) and level 2 (informal deduction) (Nusaibah et al., 2021). As a result, students who are not at the same level of geometric thinking development will not have the same picture of solving the problem (Idris et al., 2018).

The explanation shows that there is a relationship between students' mathematical literacy skills and each level of thinking development, where each student who is not the same level of thinking development will not have the same mathematical literacy skills. This study aims to describe the mathematical literacy skills of VIII grade students of SMP Negeri 3 Dampelas in solving geometry problems in terms of Van Hiele's level.

METHODS

The type of research used is qualitative research with a descriptive approach, where this research is conducted to describe students' mathematical literacy skills in solving geometry problems in terms of Van Hiele's level of thinking.

The research was conducted in class VIII junior high school and three students were used as research subjects with their thinking development at level 0, level 1 and level 2 in Van Hiele's thinking development. The subjects were selected based on the student thinking identification test or Van Hiele Geometry Test (VHGT) developed by (Usiskin, 1982) in The Cognite Development and Achievement in Secondary School Geometry Project (CDASSG). After the subject was selected, then the researcher gave the subject a test of mathematical literacy skills. Then after giving the test questions the researcher conducted interviews on the research subjects, the interviews used in this study were unstructured so that researchers could more easily obtain more in-depth information from the interviewed subjects. After that, the researchers analyzed the data obtained to produce a description of the analysis of mathematical literacy using the data analysis technique of (Miles et al., 2014).

In this study, researchers used indicators of mathematical literacy according to (Utami et al., 2020), namely: (1) formulating real problems in problem solving; (2) using mathematics in problem solving; (3) interpreting solutions in problem solving; and (4) evaluating solutions in problem solving. The indicators of mathematical literacy skills are shown in table 1 below:

Table 1: Indicators of Mathematical Literacy Skills

Indicator	Descriptors
Formulate real problems in problem solving	Students are able to write down the information contained in the problem what is known and asked.
Using math in problem solving	Students are able to write the formula that will be used in working on the given problem into mathematical form.
Interpreting solutions in problem solving	Students are able to connect and solve problems on the flat-sided block problem.
Evaluate solutions in problem solving	Students are able to re-explain answers with arguments or writing.

RESULTS AND DISCUSSION

Determination of subjects in this study using the Van Hiele Geometry Test (VHGT). Based on the classification written test results obtained on each student, the data of students who are at level 0, level 1 and level 2 of Van Hiele's thinking development according to predetermined criteria are presented in table 2 below:

Table 2: Indicators of Mathematical Literacy Skills

Van Hiele's Levels of Thinking	Total
Level 0	16
Level 1	5
Level 2	2

In this study, the researcher took three subjects, namely one level 0 student, one level 1 student and one level 2 student. In addition to seeing the results of students' written tests, taking subjects is also based on recommendations from the mathematics subject teacher of class VIII SMP Negeri 3 Dampelas regarding students who can be used as subjects by considering student readiness. After the research subject was determined, then the subject was given a test. The test was given to obtain data about students' ability to solve problems. Some time after being given the test, the subject was interviewed by the researcher to get deeper information from the subject regarding the answers to the problems given.

Exposure of data continued with data credibility test used time triangulation. The time triangulation carried out is based on the results of the written test question 1 (S1) and question 2 (S2) of the flat-sided beam problem that has been prepared by the researcher. To test the credibility of the data obtained in the implementation of written tests and interviews S1, written tests and interviews S2 were conducted. The written test in this study used an equivalent problem. If the written test data and interviews have converged to the same meaning then the data is credible.

Analysis of subject data in this study based on indicators of mathematical literacy skills, obtained valid data regarding students' mathematical literacy skills in solving mathematical problems.

1. Data Analysis of Subject Level 0 Van Hiele Thinking (NH)

a. Formulate real problems in problem solving

Based on the results of the answers and interview transcripts, it can be described that at the stage of formulating real problems in solving the problem of solving the problem of building a flat-sided beam, the subject is able to identify the information included in the problem given, namely writing what is known from the problem using a statement sentence. The subject also writes and describes the subject that is asked from a sentence containing a command sentence. So it can be concluded that the subject meets the indicators at the stage of formulating real problems in problem solving.

b. Using math in problem solving

Based on the results of the answers and interview transcripts, it can be described that at the stage of using mathematics in problem solving, the subject is able to change the problem in the problem by finding information in the problem in words that contain a mathematical concept, namely, "length, width, and height". the subject knows the concept of beam area with information from known data. So it can be concluded that the subject fulfills this indicator.

c. Interpreting the solution in problem solving

Based on the results of the answers and interview transcripts, it can be described that the subject has not been able to interpret the solution in the problem. This means that the subject has not been able to connect knowledge about the surface area of the beam to make a solution in solving the problem. So it can be concluded that the subject does not meet the indicators at this stage.

d. Evaluating Solutions in Problem Solving

Based on the results of the answers and interview transcripts, it can be described that the subject has not been able to write and explain the plan step by step the answers that have been done, the answer to the problem solving is not answered completely because of confusion to solve the problem. So it can be concluded that the

subject does not meet the indicators at the stage of evaluating solutions in problem solving.

2. Data Analysis of Subject Level 1 Van Hiele Thinking (NH)

a. Formulate real problems in problem solving

From the results of the answers and interview transcripts, it can be described that at this stage the subject can identify the information available in the problem given, namely writing and describing what is known from the problem such as wall length, wall width, wall height, and the cost of painting the hall per meter. The subject can also write and explain what is asked in the question, namely how much the overall cost of painting the hall is. So it can be concluded that the subject meets the indicators at this stage.

b. Using Math in Problem Solving

Based on the results of the answers and interview transcripts, it can be described that at this stage, the subject is able to explore the meaning of the words contained in the statement sentence so that the subject concludes that the problem relates to the surface area of the wall, the subject is able to write the formula to be used correctly. So it can be concluded that the subject meets the indicators at this stage.

c. Interpreting the Solution in Problem Solving

Based on the results of the answers and interview transcripts, it can be described that at the stage of interpreting solutions in problem solving, the subject already knows that the first step in solving problem S1 is related to the concept of beam area and with information from known data in the form of the size of the hall. So that the subject makes a plan to solve S1, namely making a mathematical model of wall length p, wall width l, wall height t. Then the subject uses the formula $2(p + l) \times t$ to solve the problem because based on the statement sentence in the problem that only the inner wall will be painted for the roof with the base not. So it can be concluded that the subject meets the indicators at this stage.

d. Evaluating Solutions in Problem Solving

Based on the results of the answers and interview transcripts, it can be described that at the stage of interpreting solutions in problem solving, the subject has not been able to explain the steps of solving the problem using arguments or writing smoothly. So it can be concluded that the subject fulfills the indicators at the stage of interpreting solutions in problem solving.

3. Data Analysis of Subject Level 2 Van Hiele Thinking (NH)

a. Formulating Real Problems in Problem Solving

Based on the results of the answer sheet and interview transcripts, it can be described that at the stage of formulating real problems in solving problems solving flat-sided block space building problems, the subject is able to identify the information available in the problem given, namely writing what is known from the problem such as wall length, wall width, wall height, and the cost of painting the hall per meter. The subject can also write and explain what is asked in the question, namely how much the overall cost of painting the hall is. So it can be concluded that the subject fulfills the indicators at the stage of formulating real problems in problem solving.

b. Using Math in Problem Solving

Based on the results of the answers and interview transcripts, it can be described that at the stage of using mathematics in problem solving, the subject is able to understand the meaning of the words contained in the statement sentence "the inside wall will be painted" so that the subject concludes that the problem relates to surface area, the subject is able to write the formula to be used correctly and calculate the overall cost of painting using the mathematical rules of addition and multiplication. So it can be concluded that the subject meets the indicators at the stage of using mathematics in problem solving.

c. Interpreting the Solution in Problem Solving

Based on the results of the answers and interview transcripts, it can be described that at the stage of interpreting the solution in problem solving, the subject already knows that the first step in solving problem S1 is related to the concept of beam area with known data information in the form of the size of the hall room. So that the subject makes a plan to solve S1, namely making a mathematical model of wall length p, wall width l, wall height t. Then the subject is able to apply his knowledge

of the surface area of walls to be painted without a base and roof using the formula 2(p + l) × t, multiplication of integers 16×4,2×64 and addition of integers 9+7. This shows that the subject is able to master the concepts underlying the mathematical model created. So it can be concluded that the subject meets the indicators at the stage of interpreting solutions in problem solving.

d. Evaluating Solutions in Problem Solving

Based on the results of the answers and interview transcripts, it can be described that at the stage of interpreting solutions in problem solving, the subject is able to provide an explanation of the steps in solving the problem using arguments or writing smoothly and is able to find the correspondence between the problem solving and the known information to ensure that the answer he gets is correct. So it can be concluded that the subject fulfills the indicators at the stage of interpreting solutions in problem solving.

CONCLUSION

The results of data analysis of mathematical literacy skills that have been carried out can be concluded that: (1) Van Hiele level 0 thinking subjects are only able to fulfill two of the four indicators of mathematical literacy skills, namely the subject is able to formulate real problems in problem solving the subject can write down what is known and asked, using mathematics in problem solving the subject is able to convert problems to mathematical form and is able to write formulas, but has not been able to interpret solutions in problem solving and evaluate solutions in problem solving; (2) Van Hiele level 1 thinking subjects are able to fulfill three of the four indicators of mathematical literacy skills, namely formulating real problems in problem solving the subject is able to write down what is known and asked, using mathematics in problem solving the subject is able to convert problems to mathematical form, interpreting the solution of the problem to solve the problem, but unable to evaluate the solution in problem solving; (3) Van Hiele level 2 thinking subjects are able to fulfill the four indicators of mathematical literacy skills, namely formulating real problems in problem solving, being able to write down what is known and asked, using mathematics in solving problems, interpreting solutions from problems in problem solving, and evaluating solutions in solving problems.

ACKNOWLEDGMENTS

The researcher would like to thank the school and all students who have been willing to be involved in this study. The researcher would also like to thank all those who helped and guided the researcher in completing this study.

REFERENCES

Amaliya, I., & Fathurohman, I. (2022). Analisis Kemampuan Literasi Matematika Ditinjau Dari Gaya Belajar Siswa Sekolah Dasar. *JRPD:Jurnal Riset Pendidikan Dasar*, *05*(April), 45–56.

Genc, M., & Erbas, A. K. (2019). Secondary Mathematics Teachers ' Conceptions of Mathematical Literacy. *IJEMST:International Journal of Education in Mathematics, Science and Technology Volume*, *7*(3).

Idris, M. (2018). Profil Pemecahan Masalah Bangun Datar Segitiga Ditinjau Dari Level Perkembangan Berpikir Van Hiele pada Siswa SMP Negeri 3 Palu. 5(3)

Khorifah, I., Wijayanto, Z., & Sulistyowati, F. (2022). kegiatan formal , nonformal , maupun informal (Rasnawati et al ., 2019), oleh karena itu pendidikan sehari – hari supaya dapat lebih siap dalam menjalani tantangan kehidupan (Stacey & Turner , 2015). ketanggapan dalam konsep – konsep matenatika yang p. *Prosiding Seminar Nasional Pendidikan Matematika*, *4*(1).

Lestari, R. D., & Effendi, K. N. S. (2022). Analisis Kemampuan Literasi Matematis Siswa SMP Pada Materi Bangun Datar. *Biormatika: Jurnal Ilmiah Fakultas Keguruan Dan Ilmu Pendidikan*, *8*(1), 63–73.

Makhmudah, S. (2018). Analisis Literasi Matematika terhadap Kemampuan Berpikir Kritis Matematika dan Pendidikan Karakter Mandiri.

Manalu, O., Naibaho, T., & Manik, E. (2023). Analisis Kemampuan Literasi Matematis Dan Pemecahan Masalah Siswa Terhadap Hasil Belajar Aspek Kognitif Pada Materi Barisan Dan Deret Aritmatika Email : Offiani Manalu (offiani.manalu@student.uhn.ac.id) Analisis Kemampuan Literasi Matematis Dan Pemecaha. *JLPD:Jurnal Literasi Pendidikan Dasar*, *4*(2), 11–18.

Maslihah, S., Waluya, S. B., Rochmad, & Suyitno, A. (2020). The Role Of Mathematical Literacy To Improve High Order Thinking Skills. *Journal of Physics: Conference Series*. https://doi.org/10.1088/1742-6596/1539/1/012085

Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative Data Analysis* (Vol. 4, Issue 1).

Nusaibah, N., Pramudya, I., & Subanti, S. (2021). Geometric Thinking Skills of Seventh Grade Students on the Topic of Triangle and Quadrilateral Based on Van Hiele Geometry Learning Theory Geometric Thinking Skills of Seventh Grade Students on the Topic of Triangle and Quadrilateral Based on Van Hiele Ge. *Journal of Physics: Conference Series*. https://doi.org/10.1088/1742-6596/1776/1/012020

Purwanti, A. F., Mutrofin, M., & Alfarisi, R. (2021). Analisis Literasi Matematika Ditinjau dari Kecerdasan Matematis-Logis Siswa. Jurnal Ilmu Pendidikan Sekolah Dasar, 8(1), 40. https://doi.org/10.19184/jipsd.v8i1.24775

Rahayu, S., & Jupri, A. (2021). Geometrical thinking of junior high school students on the topic of lines and angles according to Van Hiele theory Geometrical thinking of junior high school students on the topic of lines and angles according to Van Hiele theory. *Journal of Physics: Conference Series*, 1–6. https://doi.org/10.1088/1742-6596/1806/1/012089

Soenarjadi, G. (2020). Profil Pemecahan Masalah Siswa Pada Masalah Geometri ditinjau dari Perbedaan Jenis Kelamin dan Gaya Belajar. *JRPIPM:Jurnal Riset Pendidikan Dan Inovasi Pembelajaran Matematika*, *3*(2), 78–91.

Usiskin, Z. (1982). Van Hiele Levels and Achievement in Secondary School Geometry. CDASSG Project. Chicago Univ, 231. https://eric.ed.gov/?id=ED220288

Utami, N., Sukestiyarno, Y., & Hidayah, I. (2020). Kemampuan Literasi dalam Menyelesaikan Soal Cerita Siswa Kelas IX A. 3(1).