

Review

Literature Review: Students' Mathematical Understanding in Solving Mathematics Problems

Wilda Fakhira Sjahrawi, Puguh Darmawan*, Imam Rofiki

Citation: Sjahrawi, W. F.; Darmawan, P.; Rofiki, I. Literature Review: Students' Mathematical Understanding in Solving Mathematics Problems. *JIPM*. 2024, 12, x. <https://doi.org/10.56587/jipm.v3i1.90>

Academic Editor: Siraj

Received: January 2024

Accepted: May 2024

Published: May 2024



Copyright: © 2024 by the authors. Submitted for possible open-access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

¹ Universitas Negeri Malang; wilda.fakhira.2003114@students.um.ac.id

² Universitas Negeri Malang; puguh.darmawan.fmipa@um.ac.id

³ Universitas Negeri Malang; imam.rofiki.fmipa@um.ac.id

* Correspondence: puguh.darmawan.fmipa@um.ac.id; Program Studi Pendidikan Matematika, Departemen Matematika, Universitas Negeri Malang, Jl. Semarang 5 Malang 65145 Jawa Timur, Indonesia

Abstract: This research aims to conduct a literature review on students' mathematical understanding ability in solving problems on ratio and scale material at the junior high school level and to understand the importance of mathematical understanding for students in the learning process so that students are able to solve mathematical problems and are able to see the importance of students' mathematical understanding in everyday life. The method used in the research is a literature review of various indexed sources with the source of the study in the form of students' mathematical understanding in mathematics learning. It is necessary to teach ratios to students with a high level of mathematical understanding in addition to forcing them to memorize formulas. Moreover, as a means of promoting good comprehension during the learning process, students receive additional, varied practice questions. In order to further encourage students to improve their mathematical grasp of ratio content, teachers should also play a role in encouraging a type of early appreciation in the development of students' mathematical understanding and by giving them several opportunities to review and fix errors.

Keywords: literacy; mathematical understanding; ratio

1. Introduction

Learning is a process of interaction between students and teachers in a learning environment. It can run optimally if it involves the main components, namely students, educators, and learning resources, in a learning environment (Aprida & Dasopang, 2007). Learning is an activity of interacting with each other that is done consciously to achieve the desired goal. Where good learning has a high level of accuracy towards the goals achieved. In addition, good learning produces high creativity and understanding.

Mathematics is the science of numbers and space; mathematics is the study of pattern relationships, shapes, and structures; mathematics is an abstract and deductive science; and mathematics is a human activity

(Suherman 2003, in Purwaningsih and Marlina 2022). So far, math is one of the lessons that is considered difficult by some students. In the implementation of mathematics learning, there are still various challenges and difficulties faced by students (Sari et al., 2016). One of the factors that cause students to experience difficulties is the lack of mathematical understanding of students in mathematics.

Mathematical understanding ability is an ability based on students' knowledge of concepts, principles, procedures, and solving strategies for a problem that is displayed. Someone who has mathematical understanding ability is the understanding of people in knowing what they learn, the steps they have taken, can and understand using concepts in the context of mathematics and outside the context of mathematics (Wijaya et al., 2018). Research (Purwaningsih & Marlina, 2022) states that the majority of students have a moderate level of understanding, while a small proportion have a high or low level of understanding. This study also concluded that there were variations in students' ability to understand mathematical concepts, with most falling into the moderate category.

Radiusman's (2020) research also emphasizes the connection between mathematical concepts and real-life applications by providing them with a strong foundation of knowledge and skills. When students have a deep understanding of mathematical concepts, they can apply their knowledge to real-life situations and make informed decisions. In addition, understanding math concepts helps students develop critical thinking and problem-solving skills. They learn to analyze problems, identify relevant information, and apply appropriate mathematical strategies to find solutions.

2. Methods

The type of research used in this article is a type of literature study or what we often call a literature review. A literature review is an important tool as a contact review because the literature is very useful and helpful in providing context and meaning in the writing that is being through a literature review the researcher can state clearly and the reader knows, why the thing he wants to study is a problem that must be researched both in terms of the subject and the environment studied both in terms of the relationship of the research with it with other relevant research (Atinga et al., 2009). This research takes sources from articles and journals and research that has been done. These theoretical references can be used as a strong basis for understanding the importance of students' mathematical cultivation in solving problems on ratio and scale materials. The theoretical references taken will also be used as a strong basis for understanding the importance of students' mathematical understanding. In writing this article, researchers will develop a series of discussions based on relevant journals or research as the main material for writing.

The keywords used to reduce the selected articles are mathematical understanding and high school students. The websites used to access articles are ResearchGate and Google Scholar. There were four main articles studied. The article is presented in Table 1.

Table 1. List of Article

Title	Author	Year
Analisis Kemampuan Pemahaman Konsep Matematis Siswa Smp Kelas VII Pada Materi Bentuk Aljabar	Purwaningsih, Sri Wahyu, and Rina Marlina	2022
Analisis Kemampuan Pemahaman Matematis Siswa Kelas IX Pada Materi Bangun Ruang	Wijaya, Tommy Tanu, Neng Suci Septiani Dewi, Indah Retta Fauziah, and M. Afrilianto	2018
Analisis Kemampuan Pemahaman Matematis Siswa Pada Materi Turunan Fungsi Kelas XI SMA	Lea, Theresia Sukma Mantili, and Etthy Christin	2022
Analisis Pemahaman Konsep Matematika Siswa Kelas VII Berdasarkan Taksonomi Solo (Structure Of Observed Learning Outcomes) Pada Materi Perbandingan	Naifio, Elvira Riyani Mau, Fitriani, and Meiva Marthaulina Lestari Siahaan	2023

3. Results and Discussion

3.1. Mathematical Understanding

Understanding has the root word understanding. Understanding is an action based on a statement to an activity that a person can control as a response to the statement or activity. Literally, understanding is defined as the broad knowledge possessed by a person. According to Faye (in Radiusman, 2020), understanding is an active process when individuals connect new information with old knowledge through factual connections. Comprehension activities are divided into several cognitive processes, including describing problems, demonstrating, categorizing, formulating, concluding, comparing, and explaining these things. Alan and Afriansyah (2017) explained that understanding refers to the ability to understand the meaning of the material. This aspect of the material is one level above knowledge and is at a lower level of thinking.

According to Duffin & Simpson (Kesumawati, 2018), concept understanding is the student's ability to (1) explain concepts, which means that students can re-express what has been communicated to them. For example, when students learn the properties of addition and subtraction operations, they can restate the definitions of addition operations, subtraction operations, commutative properties, associative properties, and distributive properties. If students are asked the question, "State the nature of the operation on addition?" then students can answer the question precisely and accurately. (2) using concepts in a variety of

different situations; for example, in everyday life, if a student intends to give his friend a gift in the form of a tin piggy bank that has been coated with a fabric material, the can is available at home, but the fabric material must be purchased. The student has to think about how many meters of fabric he has to buy? How much money does he have to buy the fabric? To think about how much fabric to buy means that the student already knows the concept of the surface area of the can to be covered and the concept of social arithmetic.

Kesumawati (2018) stated that understanding mathematical concepts is a crucial part of the mathematics learning process because understanding concepts is an essential foundation for solving mathematical problems and problems in everyday life. Similar results were also stated by Susiaty and Haryadi (2019), who conducted research on seventh-grade students with ratio material. The study explained that students' mathematical understanding needs to be improved again because of the many internal and external factors that affect the performance of students' understanding of the material. The errors that occur in students are how to define concepts in writing, represent a concept in the form of models, diagrams, and symbols, identify examples and non-examples of a ratio, and change one form of representation to another. In line with this, there are factors that cause students' mathematical understanding to be lacking, namely teacher errors in providing sufficient learning, lack of space for questions and answers, and lack of attention to the level of student abilities in the learning process.

From this explanation, it can be concluded that mathematical understanding is the ability to recognize, identify, understand procedures, and apply mathematical concepts and principles. Therefore, students need to be considered in the learning process so that their mathematical understanding can continue to increase. Efficient and effective learning can improve students' mathematical understanding in the learning process. Therefore, teacher performance is important in guiding students, paying attention to student performance, and providing direction in the learning process to improve students' mathematical understanding.

3.2. Ratio and Scale Problem

Kintoko and Hendrianus (2021) explained in the initial observation, namely the interview session that students in class VII A needed help with ratio material. This can be seen in their process of solving problems is very disorganized and less than optimal in the answer results. In addition, they also revealed that not only in the learning process at school they also had difficulties when completing math assignments. These problems result in students' understanding of the material which is felt to be lacking and needs to meet the standards to continue the material. This is also the same as described by Saputri, Susanti, and Aisyah (2017) that some students have difficulty in distinguishing value ratios and inverse value ratios. The process of understanding material based on student curiosity is not

obtained because of the motivation of students who need help understanding the value ratio and inverse value ratio. Therefore, it is necessary to approach the process of exchanging material between teachers and students to improve their understanding of the material better.

Lea, Mantili, and Christin (2022) used a research instrument: a written test containing questions based on indicators of student comprehension skills that had previously been carried out in preliminary research. It was explained that this instrument was intended for 8 students who were deemed to meet the research criteria. In the first indicator, students will take a test of understanding ability with a high category where students determine the ratio worth with the results obtained. Namely, students can answer correctly and precisely. As for the medium category, students determine the inverse value ratio with the results of 1 out of 8 students making mistakes in the work with the context of not understanding the problem correctly so that they have difficulty in the work process. For the low category, students were asked to apply the concept of inverse value ratio with the result that 1 out of 8 students needed to correct the formula correctly. Commensurate with research, Naifio, Fitriani, and Siahaan (2023) used the Solo taxonomy (Structure of Observed Learning Outcomes) using 5 subjects who were then classified at five levels of thinking, namely structural thinking level, unstructured thinking level, multiple thinking levels, relational thinking level and extended abstract thinking level. At the prestructural level of thinking, there is one subject who is unable to understand the procedure of ratio material, while at the unistructural level of thinking there is one subject who is able to use the information on the concept of ratio, namely restating it well, but this subject does not have sufficient knowledge in the procedure for working on ratio problems. The multistructural level of thinking shows students who understand the problem and can plan the problem but have yet to be able to solve the problem correctly. At this level, there is one subject who meets the indicator criteria. For the relational level of thinking, there is one subject who can do the concept and procedure to the final solution of the ratio problem but has yet to be able to draw conclusions on the answer correctly. The last level, namely the extended abstract thinking level, is a high level of thinking by looking at abstracts that are expanded by students as part of understanding the problem in the form of both data and information. At this stage there is one subject who meets the criteria, namely being able to restate concepts, classify objects correctly and explain a concept correctly.

In research Hamidah (2022) by using a realistic approach get the results that there are 3 student problems. The study divided 2 groups to interact and argue between group members. The process uses the question of student understanding in the buying and selling process in everyday life. After being given, it was found that the two groups could not find the results and experienced difficulties such as the first group understanding

the concept of ratio but group two did not understand the concept. The second problem is students' understanding in developing and understanding valued ratio. Here both groups drew lines and squares as a form of their understanding of the problem so that it was found that both groups understood the concept of ratio worth correctly. Furthermore, in the third problem, students are given questions about understanding the concept of inverse value ratio using manipulative media well. The results obtained are that both groups can understand the concepts and procedures of inverse value ratio correctly. In line with research Hamidah, Putri, and Somakim (2018) who used story problems as a form of student understanding of ratio material. In the first activity, the teacher asked about the pretest that had been carried out at the previous meeting by asking again about the ratio material and providing a lighter question in the form of worth ratio material, namely stories of everyday life. The next activity students are given time to reveal a story related to the ratio material worth such as the story when the mother is shopping at the market and so on. Through these two activities, it can be seen that students can understand ratio material on problems in everyday life.

Regarding the research conclusions, it is found that students have different levels of ability. In the low category, students' mathematical ability is 12.5%, the medium category with a presentation of 75% and the high category gets the results of 12.5%. This shows that students' mathematical abilities on ratio materials are in the low category, which means that students can already understand the concepts and procedures appropriately. Lea et al. (2022). Compared to research by Hayu et al. (2019), which states that seventh-grade students of SMP Negeri 2 Salo have a high category in mathematical understanding of ratio material. it is early stated that the results obtained are 80.30%. This can be seen in the process of working on comparative material that many students understand the concepts and procedures and can explain back to the answer results. Meanwhile, in research, Sari (2020) explained that there are still many students who do not understand concepts, cannot combine several concepts in one problem, there are students' negligence in using concepts, and there is no significant solution in ratio material. These problems are based on the need for more student knowledge, students who are less trained in practice problems, and the lack of teacher motivation in learning.

4. Conclusions

Students who have a good level of mathematical understanding are not only required to memorize formulas but must be given an understanding of the concept of ratios. Not only that, students are also given more exercise questions that vary as a place for high understanding in the learning process. Furthermore, the role of the teacher in motivating a form of initial appreciation in developing students' mathematical understanding and providing many opportunities for students to re-

examine and correct mistakes to encourage students to deepen their mathematical understanding of ratio material.

Researchers also revealed that teachers should provide more opportunities for students to explore comparative material by accommodating media or learning materials to support student understanding. This aims as a form of responsibility in the teacher's position as a bridge of knowledge for students. Students also need to be given an understanding of the importance of learning in everyday life to realize the importance of learning in understanding a problem in everyday life.

References

Atinga, Roger A. n.d. "Literature Review." (2009).

Purwaningsih, Sri Wahyu, and Rina Marlina. 2022. "Analisis Kemampuan Pemahaman Konsep Matematis Siswa Smp Kelas VII Pada Materi Bentuk Aljabar." *Jurnal Pembelajaran Matematika Inovatif* 5(3):639–48. doi: 10.22460/jpmi.v5i3.639-648.

Radiusman. 2020. "Studi Literasi: Pemahaman Konsep Anak Pada Pembelajaran Matematika." *FIBONACCI: Jurnal Pendidikan Matematika Dan Matematika* 6(1):1. doi: 10.24853/fbc.6.1.1-8.

Sari, Deka Purnama, Nurochmah, Haryadi, and Syaiturjim. 2016. "Meningkatkan Kemampuan Pemahaman Matematis Melalui Pendekatan Pembelajaran Student Teams Achivement Division." *Jurnal Riset Pendidikan Matematika* 3(1):16–22. doi: 10.21831/jrpm.v3i1.7547.

Wijaya, Tommy Tanu, Neng Suci Septiani Dewi, Indah Retta Fauziah, and M. Afrilianto. 2018. "Analisis Kemampuan Pemahaman Matematis Siswa Kelas IX Pada Materi Bangun Ruang." *UNION: Jurnal Ilmiah Pendidikan Matematika* 6(1):19–28. doi: 10.30738/.v6i1.2076.

Alan, Usman Fauzan, and Ekasatya Aldila Afriansyah. 2017. "Kemampuan Pemahaman Matematis Siswa Melalui Model Pembelajaran Auditory Intellectually Repetition Dan Problem Based Learning." *Jurnal Pendidikan Matematika* 11(1). doi: 10.22342/jpm.11.1.3890.67-78.

Hamidah. 2022. "Pemahaman Konsep Perbandingan Senilai Dan Berbalik Nilai Melalui Pendekatan Pendidikan Matematika Realistik Indonesia Pada Siswa Smp." *Seminar Nasional Pendidikan Matematika (SNAPMAT) 2022* 78–86.

Hamidah, Dewi, Ratu Ilma Indra Putri, and Somakim Somakim. 2018. "Eksplorasi Pemahaman Siswa Pada Materi Perbandingan Senilai Menggunakan Konteks Cerita Di SMP." *Jurnal Riset Pendidikan Dan Inovasi Pembelajaran Matematika (JRPiPM)* 1(1):1. doi: 10.26740/jrpiPM.v1n1.p1-10.

Hayu, Eka, Rossa Linna, Maimunah, and Yenita Roza. 2019. "Analisis Kemampuan Koneksi Matematis Siswa Dalam Menyelesaikan Masalah Pada Materi Perbandingan." *AdMathEdu: Jurnal*

Ilmiah Pendidikan Matematika, Ilmu Matematika Dan Matematika Terapan 9(1):11. doi: 10.12928/admathedu.v9i1.13955.

Kesumawati, Nila. 2018. "Konsep Matematis; Pemahaman Konsep Matematik Dalam Pembelajaran Matematika." *Journal of Chemical Information and Modeling* 53(9):228–35.

Kintoko, and Hendrianus. 2021. "Analisis Kemampuan Pemecahan Masalah Matematis Siswa Kelas VII A Pada Materi Perbandingan Di SMP BOPKRI 5 Yogyakarta." *Didactical Mathematics* 3(2):92–99. doi: 10.31949/dm.v3i2.1811.

Lea, Theresia Sukma Mantili, and Etthy Christin. 2022. "Analisis Kemampuan Pemahaman Matematis Siswa Pada Materi Turunan Fungsi Kelas XI SMA." *Juwara Jurnal Wawasan Dan Aksara* 2(1):15–24. doi: 10.58740/juwara.v2i1.35.

Naifio, Elvira Riyani Mau, Fitriani, and Meiva Marthaulina Lestari Siahaan. 2023. "Analisis Pemahaman Konsep Matematika Siswa Kelas VII Berdasarkan Taksonomi Solo (Structure Of Observed Learning Outcomes) Pada Materi Perbandingan." *GAUSS: Jurnal Pendidikan Matematika* 6(1):67–78. doi: 10.30656/gauss.v6i1.5441.

Saputri, Intan, Ely Susanti, and Nyimas Aisyah. 2017. "Kemampuan Penalaran Matematis Siswa Menggunakan Pendekatan Metaphorical Thinking Pada Materi Perbandingan Kelas VIII Di SMPN Indralaya Utara." *Jurnal Elemen* 3(1):15. doi: 10.29408/jel.v3i1.302.

Sari, Nicky Maya. 2020. "Analisis Kesulitan Siswa Dalam Mengerjakan Soal Matematika Materi Perbandingan Kelas VII SMP Luhur Baladika." *Jurnal Equation: Teori Dan Penelitian Pendidikan Matematika* 3(1):22–33.

Susiaty, Utin Desy, and Rahman Haryadi. 2019. "Analisis Kemampuan Pemahaman Matematis Siswa Dalam Menyelesaikan Soal Perbandingan Di Kelas Vii Smp." *Jurnal Pendidikan Informatika Dan Sains* 8(2):239. doi: 10.31571/saintek.v8i2.1574.