MaPan : Jurnal Matematika dan Pembelajaran
p-ISSN: 2354-6883 ; e-ISSN: 2581-172X
Volume 11, No 2, Dec 2023 (326-336)
DOI: https://doi.org/10.24252/mapan.2023v11n2a8

ANALYSIS OF CONCEPT UNDERSTANDING IN THE PYTHAGORAS THEOREM AT STUDENTS SMPN 1 KOTABARU

Rahmi Yuliana[1)], Evi Novianty[2)], Muhammad Yusuf[3)]
[1,2,3]Program Studi Pendidikan Matematika, STKIP Paris Barantai
[1,2,3]Jl. Veteran Km.02. No. 15 B Kotabaru, Indonesia
Email: rahmiyuliana10@gmail.com[1)], noviantyevi3@gmail.com[2)], muhammad.yusuf@stkip-pb.ac.id[3)]

Received October 12, 2023; Revised December 02, 2023; Accepted December 03, 2023

Abstract:
The aims of this study were 1) to analyze the conceptual understanding of students in class VIII F in understanding the Pythagorean theorem and 2) to find out the factors that cause misconceptions in class VIII F students in solving problems regarding the Pythagorean theorem. The approach used in this research is qualitative research. The method used in this research is the descriptive qualitative method. There are 3 subjects in this research. Data was collected using research instruments in the form of learning achievement tests and interviews. The results of the study stated that students' conceptual understanding subject S1 had a high conceptual understanding even though S1 was less thorough in checking answers. Whereas the S3 subject was able to explain the description of the Pythagorean theorem, it's just that the S3 could not continue the solving procedure on the Pythagorean triple problem due to lack of thoroughness, being in a hurry when working on the problem, and not understanding the Pythagorean theorem material. S2 was not able to understand some of the questions presented. It could not continue the completion procedure according to the questions due to not being thorough, easily forgetting the material that had been taught, being in a hurry when working on the questions, and not understanding the questions that had been given.

Keywords: Analysis, Conceptual Understanding, Pythagorean Theorem

ANALISIS PEMAHAMAN KONSEP TEOREMA PYTHAGORAS PADA PESERTA DIDIK SMP NEGERI 1 KOTABARU

Abstrak:
Tujuan penelitian ini adalah 1) untuk menganalisis pemahaman konsep siswa kelas VIII F dalam memahami materi teorema pythagoras dan 2) untuk mengetahui faktor-faktor yang menyebabkan kesalahan konsep pada siswa kelas VIII F dalam menyelesaikan soal mengenai teorema Pythagoras. Pendekatan yang digunakan dalam penelitian ini adalah penelitian kualitatif. Metode yang digunakan dalam penelitian ini adalah metode deskriptif kualitatif. Subjek berjumlah 3 orang. Data dikumpulkan dengan menggunakan instrumen penelitian berupa tes hasil belajar dan wawancara. Hasil penelitian menyatakan bahwa pemahaman konsep peserta didik subjek S1 memiliki pemahaman konsep yang tinggi, meskipun begitu S1

kurang teliti dalam pengecekkan jawaban. Sedangkan subjek S3 mampu menjelaskan deskripsi teorema Pythagoras, hanya saja S3 tidak dapat melanjutkan prosedur penyelesaian pada soal triple Pythagoras dikarenakan kurang teliti, terburu- buru saat mengerjakan soal, serta kurang paham mengenai materi teorema Pythagoras. S2 tidak mampu memahami beberapa soal yang disajikan dan tidak dapat melanjutkan prosedur penyelesaian yang sesuai dengan soal disebabkan oleh kurang teliti, mudah lupa dengan materi yang telah diajarkan, terburu-buru saat mengerjakan soal, dan kurang dalam memahami soal yang telah diberikan.

Kata Kunci: Analisis, Pemahaman Konsep, Teorema Pythagoras

How to Cite: Rahmi, Y. Novianty, E. & Yusuf, M. (2023). Analysis of Concept Understanding in The Pythagoras Theorem at Students SMPN 1 Kotabaru. *MaPan : Jurnal Matematika dan Pembelajaran*, *11*(2), 326-336. https://doi.org/10.24252/mapan.2023v11n2a8

INTRODUCTION

Education is a fundamental thing in human life because education aims to help every individual develop all their potential if implemented in an educational and dialogic manner. This is by the Law on the National Education System No. 20 of 2003 in article 1 paragraph 1 namely: Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have spiritual-religious strength, self-control, personality, intelligence, noble character, and skills needed by himself, society, nation and state. Learning mathematics in junior high schools has the goal that students can understand mathematical concepts, explain the interrelationships between concepts, and apply concepts or the Pythagorean theorem in a flexible, accurate, efficient, and precise way in solving problems. Learning mathematics is a teaching and learning process built by the teacher to develop students' creative thinking and to be able to construct students' ability to understand mathematical concepts in junior high school with new knowledge as an effort to improve good mastery of mathematical material (Wardhani, 2008). Likewise, the results of Karim concluded that learning by applying the guided discovery model affected students' understanding of concepts which indicated that student activity during the learning process with the guided discovery model was in very good criterion. Meanwhile, students' conceptual understanding using the guided discovery model is at a high qualification.

National education aims to educate the life of the nation and develop the Indonesian person as a whole, namely human beings who have faith and are devoted to God Almighty have noble character, have knowledge and skills, are physically and spiritually healthy, have a strong personality, are independent and have a sense of social responsibility and nationality. Contains an overview of good, noble, appropriate, true, and beautiful values for life. Therefore, the purpose of education has two functions, namely giving direction to all educational activities and achieving educational activities in a lesson. In education, the success of the teaching and learning process can be measured by the success of students participating in learning activities. This success can be seen from the level of understanding of the material and student achievement at school. Therefore, learning requires an understanding of the concept as a basis for developing further material in the world of education.

The goals of education in learning mathematics are that students are expected to have the ability to understand mathematical concepts, use reasoning, explain ideas, be able to solve problems, interpret solutions obtained, be able to communicate ideas, and have an attitude of appreciating the use of mathematics in life by showing curiosity, concern, and interest in studying mathematics, confident in solving problems logically, systematically, critically, and creatively. At the same time, the scope of learning mathematics includes numbers, measurement geometry, and data processing.

Learning mathematics at the educational level is a very decisive foundation in the formation of the nature, intelligence, and personality of students. In learning mathematics students are not only taught about writing and arithmetic but also reasoning and concepts related to everyday life so that it is possible to develop students' intelligence. Apart from that, learning mathematics also requires precision and accuracy in solving the problems/questions given so that it can shape the attitudes and personality of students to be more disciplined and respect time.

Understanding is a process that consists of the ability to explain and interpret something, being able to provide descriptions, examples, and broader and adequate explanations, and being able to provide descriptions and explanations that are more creative while concepts are something that is drawn in the mind, a thought, an idea or an understanding. Students are said to have the ability to understand mathematical concepts if they can formulate solving strategies, apply simple calculations, use symbols to represent

concepts, and change one form to another such as fractions in learning mathematics (Susanto, 2015).

Understanding is defined by the word understanding (Sumarmo, 1987). The degree of understanding is determined by the degree of relatedness of an idea, procedure, or mathematical fact which is understood as a whole if these things form a network with high interrelationships. The concept is defined as an abstract idea that can be used to classify a set of objects (Depdiknas, 2003). So that the ability to understand concepts is important because in mathematics studying concepts or topics is continuous and interconnected. According to NCTM (2000), to achieve meaningful understanding, learning mathematics must be directed at developing mathematical connection skills between various ideas, understanding how mathematical ideas are related to one another so that a thorough understanding is built, and using mathematics in contexts outside mathematics. Without understanding, concept development will be difficult for students to do alone, so they must always be encouraged by the teacher.

According to Duffin and Simpson (2000), conceptual understanding is the ability of students to (1) explain concepts, meaning that students can re-express what has been communicated to them. For example, when students learn the subject geometry of Conical Side Construction (BRSL), students can restate the definition of a cylinder, the elements of a cylinder, the definition of a cone, and the elements of a cone, the definition of a ball. If students are asked the question "What are the characteristics of BRLS?", then students can answer the question correctly; (2) using the concept in a variety of different situations, for example, in everyday life, if a student intends to give a friend a birthday present in the form of a tin piggy bank that has been covered with a cloth, the can is available at home but the fabric must be purchased. The student must think about how many meters of fabric to buy. How much money should you have to buy fabric? To think about how much fabric to buy means that the student already knows the concept of the surface area of the cans that will be coated and the concept of social arithmetic; (3) developing some consequences of the existence of the National Semester Mathematics and Mathematics Education a concept, it can be interpreted that students understand a concept as a result students can solve each problem correctly. Understanding the concept is a very important part of learning mathematics. Mathematics subjects emphasize concepts. This means that in learning mathematics

students must first understand the concept of mathematics to be able to solve problems and be able to apply this learning in the real world.

Understanding concepts is the ability of students to master a material/concept indicated in the cognitive realm, so that by understanding a concept students can know, explain, describe, compare, distinguish, classify, give examples and not examples, conclude and re-express an object with their own language (Dewi & Ibrahim, 2019). According to Novitasari (2016); Suprijono (2013) by learning concepts, students can understand and distinguish words, symbols, and signs in learning materials. Meanwhile, Radiusman (2020) added that students' understanding of concepts, especially in mathematics material, does not always have to be in the classroom, students are also able to get it through daily activities.

According to Kesumawati (2008), understanding mathematical concepts is the basis for thinking in solving mathematical problems in everyday life. A good student's understanding of mathematical concepts cannot be separated from a teacher who teaches well too. This is supported by the opinion of Karim (2011), who states that given the importance of understanding concepts for students, the teacher should teach learning material properly and correctly.

According to Risnawaty (2016), the Pythagorean theorem states that the length of the square of the hypotenuse of a right triangle is equal to the sum of the squares of the lengths of the sides. The Pythagorean theorem is often expressed in the form a^2+b^2=c^2 where a and b are the lengths of the sides of a right triangle that form a right angle, while c is the length of the hypotenuse. Based on the results of research conducted by Rohmah (2020) learning obstacles that occur in the Pythagorean theorem material, namely, students still experience difficulties in determining the concept of identifying right triangles, showing the concept, and determining the Pythagorean theorem formula, the concept of analyzing the Pythagorean theorem to solve real-life problems. Furthermore, the results of research conducted by Mulyanti, Yani, and Amelia (2018) showed that the difficulties experienced by students in solving story problems using the concept of the Pythagorean theorem were students less careful in doing calculations and writing the Pythagorean formula that was not quite right. Khoerunnisa and Sari (2021) explained that in general, the obstacles experienced by students on the Pythagorean theorem material were difficulties in understanding concepts, understanding problems, and answering problems in the Pythagorean theorem.

Based on observations on October 11, 2022, an interview was conducted with one of the teachers in the Mathematics Department at SMP Negeri 1 Kotabaru, that understanding of the concept of learning in the Pythagorean theorem material in class VIII students, especially VIII F at SMP Negeri 1 Kotabaru, seen from the learning outcomes, is still low. Judging from the results of the evaluation, it can be seen that there are still many students who do not understand mathematics, especially in the Pythagorean Theorem material. This could be an indication that students do not yet have a good understanding of concepts, especially in the Pythagorean Theorem material, so there are still some errors encountered.

The researcher wanted to examine directly the students' understanding of concepts at SMP Negeri 1 Kotabaru, while in previous studies some raised almost the same title in their thesis entitled "Analysis of Difficulties in Understanding Concepts in Pythagorean Material in Class VIII SMP Negeri 3 Sungguminasa. Therefore, researchers are interested in conducting research with the title "Analysis of Conceptual Understanding of Pythagorean Theorem Material in Class VIII F Students of SMP Negeri 1 Kotabaru". Based on the description above, the researcher formulated the following problems: 1) How is the understanding of the concepts of class VIII F in understanding the Pythagorean theorem material? 2) What factors cause students to misunderstand concepts in class VIII F in solving questions about the Pythagorean theorem? The purposes of this study are 1) to analyze the students' understanding of the concepts of class VIII F in understanding the Pythagorean theorem material; 2) to find out the factors that cause misunderstanding of concepts in class VIII F students in solving problems regarding the Pythagorean theorem.

METHODS

In this study the researcher used a qualitative descriptive research type, where descriptive research based on postpositivism philosophy was used to examine natural object conditions (as opposed to experiments), qualitative descriptive methods aimed to describe, describe, explain, explain, and answer in more detail problem to be studied by studying as much as possible an individual, a group or an event.

For taking research subjects based on purposive sampling technique seen from the category of student learning outcomes in high, medium, and low abilities as many as 3 people. The research was conducted in class VIII.F of

SMPN 1 Kotabaru from May to June in the even semester of the 2022/2023 school year at the address Jalan M. Alwi No.158 Semayap Village, Kotabaru District. The tools used to collect data used 2 instruments, namely: a description test and an interview guide. Data analysis techniques used by researchers are data reduction, data presentation, and drawing conclusions or verification.

Can be broadly seen in the following scheme:

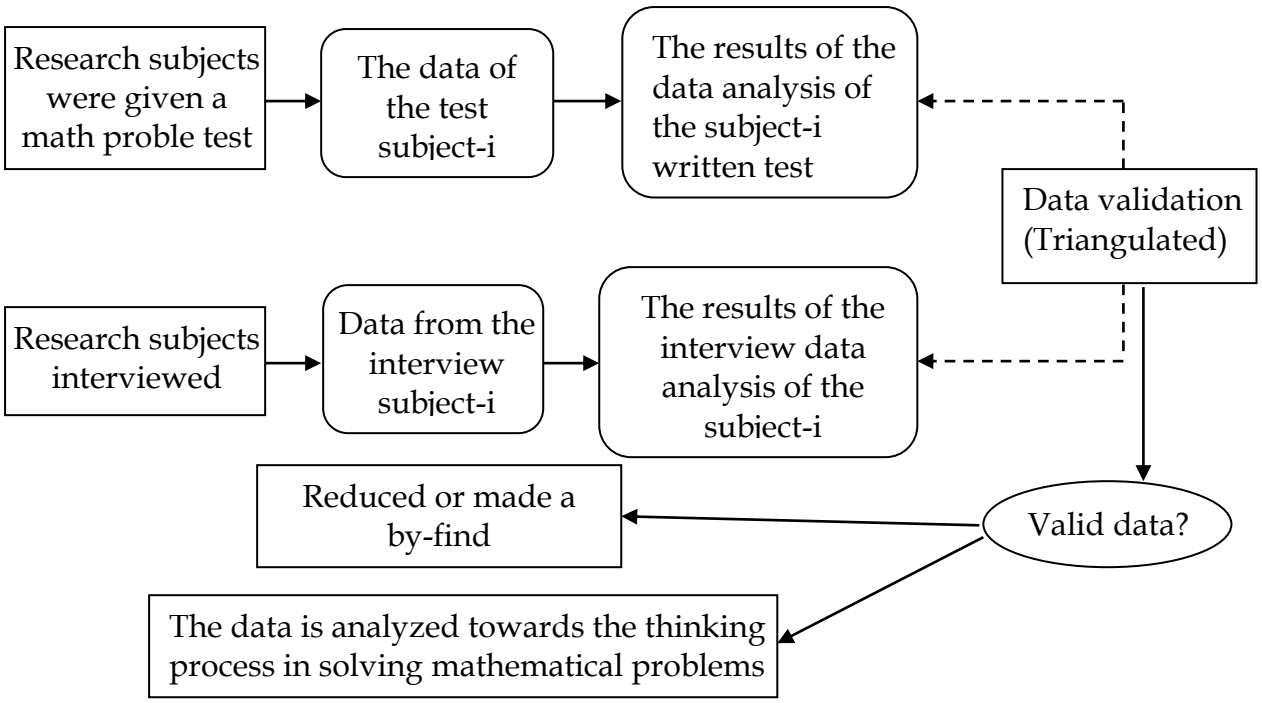

Figure1. Data Collection Process Flow

RESULTS AND DISCUSSION

Data on the learning outcomes test that the researchers held from 08.00 AM to 09.00 AM on Monday, 06 June 2022, for the following data has gone through the assessment stage, so the data presented has been obtained. The value of each subject is described as follows.

Table 1. Result by subjects' score

No	Subject	Task/ question				Total score
		1	2	3	4	
1	S1	10	35	25	20	90
2	S2	20	35	10	10	75
3	S3	15	15	10	5	45

Note: S1 = Subject 1, S2 = Subject 2, S3 = Subject 3

After analyzing the results of class VIII.F students' work at SMPN 1 Kotabaru and the results of interviews based on understanding the concepts carried out in answering tests on the Pythagorean theorem material, the following are the results of student answers obtained for each type of conceptual understanding, namely: analysis of understanding the concept of theorem material Pythagoras to students. Based on the results of the analysis, the achievement of indicators of understanding the concept can be shown in table 2 as follows.

Table 2. Achievement of Concept Understanding Indicators

HT	Subject	Indicator							Total
		a	b	c	d	e	f	g	
1	S1	100	0	66,7	100	100	100	100	80,9
	S2	100	100	66,7	100	33,7	100	33,7	76,3
	S3	100	100	66,7	33,7	100	33,7	33,7	66,8
2	S1	66,7	100	100	100	100	100	100	95,2
	S2	66,7	100	100	66,7	66,7	0	0	57,1
	S3	33,7	100	33,7	100	0	0	0	38,2

Note: a) restating a concept; b) provide examples and non-examples of a concept; c) develop necessary and sufficient conditions for a concept; d) apply a problem-solving concept or logarithm; e) use, utilize, and select certain procedures or operations; f) clarifying objects according to certain characteristics; g) present the concept in various forms of mathematical representation.

Based on the results of the analysis, and the achievement of indicators of understanding the concept above, the subject can be categorized as follows.

Table. 3 Categorization of Understanding Concepts

Total Score	Category
0-64	Low
65-84	Medium
85-100	High

So it can be concluded that subject 1 is included in the high category because in the results of tests 1 and 2, subject 1 gets a high category, while subjects 2 and 3 in test 1 get a medium category, but in test 2, subjects 2 and 3 get a low category. The previous research on Iswah Fadilah (2017) thesis entitled "Analysis of Students' Concept Understanding on Pythagorean

Theorem Material in Class VIII MTs Mardiyah Islamiyah Panyabungan" the results of this study indicate that students' conceptual understanding. Many students are unable to solve Pythagorean theorem problems because they do not understand the concept. Understanding the concept in question is knowledge of the concept of the Pythagorean theorem in seven indicators, namely the ability to (1) restate a concept, (2) clarify objects according to certain properties, (3) give examples and non-examples of concepts, (4) presenting concepts in various forms of mathematical representation, (5) developing necessary and sufficient conditions for a concept, (6) using certain procedures or operations, (7) applying objects and problem-solving algorithms.

Analysis of the factors causing the misunderstanding of concepts by Class VIII.F students of SMP Negeri 1 Kotabaru. Based on the interview above, it can be seen that each subject's mistakes include: S1 forgot to write a right triangle on test 1, question number 1, S3 was unable to get important information in the problem, so S3 could not solve the questions on test 2 numbers 3 and 4, S3 also did not understand the meaning of the questions given in question number 1. So it can be concluded that S3 was not careful in working on the questions, was in a hurry, forgot the material being taught, and did not understand/understand the intent of the questions presented. Whereas S2 on test 2 on question number 1 lacked explanation, while for questions number 3 and 4 S2 did not answer the questions well, it can be concluded that S2 was not thorough in working on the questions, S2 was also in a hurry in answering questions, S2 did not understand the material has been given so he could not answer the question properly. Factors that cause class VIII F students of SMP Negeri 1 Kotabaru to make mistakes.

CONCLUSION

Based on the results of research and discussion, it can be concluded that the understanding of the concept of grade VIII F students of SMP Negeri 1 Kotabaru in the S1 subject has a high understanding of the concept, even though S1 is less thorough in checking the answers. While the subject S3 was able to explain the description of the Pythagorean theorem, it was just that S3 could not continue the solving procedure on the Pythagorean triple problem due to lack of accuracy, rush when working on the problem, and lack of understanding of the Pythagorean theorem material. S2 cannot understand some of the questions presented and cannot continue the solving procedure

according to the questions due to lack of accuracy, easy to forget the material that has been taught, rush when doing the questions, and lack of understanding of the questions that have been given.

ACKNOWLEDGMENT

We would like to thank Junior High School State 1 of Kotabaru for funding the implementation of this research activity. In addition, thanks to those who have helped so that this research can run well.

REFERENCES

Depdiknas. (2003). *Pedoman khusus pengembangan sistem penilaian berbasis kompetensi sekolah menengah pertama (SMP) pada mata pelajaran matematika kurikulum 2004 sekolah menengah pertama (SMP)*. Jakarta: Departemen Pendidikan Nasional.

Dewi, S. Z., & Ibrahim, T. (2019). Pentingnya pemahaman konsep untuk mengatasi miskonsepsi dalam materi belajar IPA di sekolah dasar. *Jurnal Pendidikan UNIGA*, *13*(1), 130–136. https://doi.org/10.52434/jp.v13i1.823.

Duffin, J. M., & Simpson, A. P. (2000). A search for understanding. *The Journal of Mathematical Behavior*, *18*(4), 415–427. https://doi.org/h10.1016/S0732-3123(00)00028-6.

Fadilah, I. (2017). *Analisis pemahaman konsep siswa pada materi teorema pythagoras di kelas VIII MTs Mardiyah Islamiyah Panyabungan*. (Doctoral dissertation, IAIN Padangsidimpuan). Retrieved from http://etd.uinsyahada.ac.id/3067/.

Karim, A. (2011). Penerapan metode penemuan terbimbing dalam pembelajaran matematika untuk meningkatkan pemahaman konsep dan kemampuan berpikir kritis siswa sekolah dasar (studi eksperimen pada siswa kelas V SD Negeri di Kecamatan Kuta Blang Kabupaten Bireuen tahun ajaran. *Seminar Nasional Matematika Dan Terapan 2011*, 29–38.

Kesumawati, N. (2008). Pemahaman konsep matematik dalam pembelajaran matematika. *Prosiding Seminar Nasional Matematika Dan Pendidikan Matematika*, 229–235. Yogyakarta: Lumbung Pustaka Universitas Negeri Yogyakarta.

Khoerunnisa, D., & Sari, I. P. (2021). Analisis kesulitan siswa dalam menyelesaikan soal teorema phytagoras. *JPMI (Jurnal Pembelajaran*

Matematika Inovatif), *4*(6), 1731–1742. https://doi.org/10.22460/jpmi.v4i6.p%25p.

Mulyanti, N. R., Yani, N., & Amelia, R. (2018). Analisis kesulitan siswa dalam pemecahan masalah matematik siswa SMP pada materi teorema phytagoras. *PMI (Jurnal Pembelajaran Matematika Inovatif)*, *1*(3), 415–426. https://doi.org/10.22460/jpmi.v1i3.p415-426.

National Council of Teachers of Mathematics. (2000). *Principles and Standards for School Mathematics*. Reston, VA: NCTM.

Novitasari, D. (2016). Pengaruh penggunaan multimedia interaktif terhadap kemampuan pemahaman konsep matematis siswa. *FIBONACCI: Jurnal Pendidikan Matematika Dan Matematika*, *2*(2), 8–18. https://doi.org/10.24853/fbc.2.2.8-18.

Radiusman, R. (2020). Studi Literasi: Pemahaman konsep anak pada pembelajaran matematika. *FIBONACCI: Jurnal Pendidikan Matematika Dan Matematika*, *6*(1), 1–8. https://doi.org/10.24853/fbc.6.1.1-8.

Risnawaty, L. (2016). *Desain didaktis teorema pythagoras berdasarkan learning trajectory pada pembelajaran matematika sekolah menengah pertama (SMP)*. (Doctoral dissertation, Universitas Pendidikan Indonesia). Retrieved from http://repository. upi.edu/id/eprint/43911.

Rohmah, A. S. (2020). Analisis kesalahan siswa MTs dalam menyelesaikan soal pada materi teorema pythagoras. *Jurnal Pembelajaran Matematika Inovatif (JPMI)*, *3*(5), 433–442. https://doi.org/10.22460/jpmi.v3i5.433-442.

Sumarmo, U. (1987). *Kemampuan pemahaman dan penalaran matematik siswa SMA dikaitkan dengan penalaran logik siswa dan beberapa unsur proses belajar mengajar*. (Doctoral dissertation, Universitas Pendidikan Indonesia).

Suprijono, A. (2013). *Cooperative learning*. Yogyakarta: Pustaka Pelajar.

Susanto, A. (2015). *Teori belajar dan pembelajaran di sekolah dasar* (3rd ed.; Jefry, Ed.). Jakarta: Prenadamedia Group.

Wardhani, S. (2008). *Analisis SI dan SKL mata pelajaran matematika SMP/MTs untuk optimalisasi tujuan mata pelajaran matematika* (Titik Sutanti, Ed.). Yogyakarta: Pusat Pengembangan dan Pemberdayaan Pendidik dan Tenaga Kependidikan Matematika.