ANALYSIS OF STUDENTS' ERROR IN WORKING ON MATHEMATICS PROBLEMS BASED ON THE CIRCULAR MATERIAL BASED ON KASTOLAN THEORY

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Abstract

The purpose of this study is to describe the types of student errors in solving HOTS-based circle questions based on kastolan theory, then it will also be explored regarding the factors that cause errors, and the percentage of student errors when solving problems. The method that will be used is descriptive qualitative. The instruments in this study consisted of written tests, interviews, and documentation. Data analysis techniques include data reduction, presenting data, and drawing conclusions. The subjects in this study were 13 students from class VIII A of SMP Negeri 4 Randublatung in semester 2 of the 2022/2023 academic year. Then interviews will be conducted by taking 3 samples of student answers grouped based on types of conceptual, procedural, and technical errors. The results showed that the most dominant errors occurred in technical errors where errors were made in the counting process with a percentage of 69.23%. Student procedural errors were made due to the incompatibility of the steps in solving the questions which resulted in wrong answers, with a percentage of 53.84%. Students' conceptual errors were made because students misinterpreted concepts and incorrectly determined the problem solving formula, with a percentage of 46.15%. Factors that cause students to make mistakes in solving HOTS-based questions are: students are not careful in the process of calculating ranks, use formulas that do not meet the prerequisites of the formula, and incompatibility of steps in solving problems.

Keywords: Error Analysis, Cricles, HOTS Type Questions, Kastolan Theory

Abstrak

Tujuan dari penelitian ini yaitu mendeskripsikan jenis kesalahan siswa dalam menyelesaikan soal lingkaran berbasis HOTS berdasarkan teori kastolan, kemudian akan digali juga mengenai faktor yang menjadi penyebab kesalahan, dan besar persentase kesalahan siswa pada saat menyelesaikan soal. Metode yang akan digunakan adalah deskriptif kualitatif. Instrumen dalam penelitian ini terdiri dari tes tertulis, wawancara, dan dokumentasi. Teknik analisis data meliputi reduksi data, menyajikan data, dan menarik kesimpulan. Subjek dalam penelitian ini 13 siswa dari kelas VIII A SMP Negeri 4 Randublatung pada pembelajaran semester 2 tahun ajaran 2022/2023. Kemudian wawancara akan dilakukan dengan mengambil 3 sampel jawaban siswa yang dikelompokan berdasarkan jenis kesalahan konseptual, prosedural, dan teknik. Hasil penelitian menunjukan bahwa kesalahan paling dominan terjadi pada kesalahan teknik dimana kesalahan dilakukan pada proses menghitung dengan persentase 69,23%. Kesalahan prosedural siswa dilakukan karena ketidaksesuaian langkah-langkah dalam menyelesaiakan soal yang mengakibatkan kesalahan jawaban, dengan persentase sebanyak 53,84%. Kesalahan konseptual siswa dilakukan karena siswa salah dalam menafsirkan konsep serta salah menentukan rumus penyelesaian soal, dengan persentase sebanyak 46,15%. Faktor penyebab siswa melakukan kesalahan meyelesaikan soal berbasis HOTS yaitu: siswa kurang teliti dalam proses menghitung perpangkatan, penggunaan rumus yang tidak memenuhi prasyarat rumus, dan ketidaksesuaian langkah-langkah dalam menyelesaikan soal.

Kata kunci: Analisis Kesalahan, Lingkaran, HOTS, Teori Kastolan

INTRODUCTION

Education is one of the basic needs that is necessary in life, where education is able to determine and guide one's future. One of the goals that must be directed in education is to

improve self-ability according to the potential of students. The purpose stated in Law no. 20 of 2003 concerning the National Education System Article 1 paragraph 1 states that education is a conscious and planned effort that aims to create a learning atmosphere or learning process so that students are active by increasing their potential, in order to realize spiritual and religious strength, self-control, character, education, noble character, and knowledge needed by himself, citizens, and the state. Efforts to increase self-potential can be done by improving existing fields in education, one of which is mathematics.

Mathematics is closely related to abstractness when studying it, where abstract elements are not depicted as concrete patterns or plots (Annurwanda & Friantini, 2019). Fauzy & Nurfauziah (2021) stated that addition to learning mathematics is considered important, it is also often considered a complicated, difficult and scary learning. In line with the opinion of Rigusti & Pujiastuti (2020) that in reality there are still many students who still consider mathematics to be a difficult subject and have not felt the benefits of mathematics itself. In fact, by studying mathematics there are many benefits that can be obtained, namely teaching patience, how to think logically, and increasing accuracy. According to Suyitno & Kristiyajati (2016), mathematics learning aims to encourage students to be able to formulate problems, not just solve simple problems that are associated with routines in life. Likewise, the opinion of Novitasari & Wilujeng (2018) states that mathematics is a subject that has an important role in meeting practical needs and solving problems in everyday life. In life, mathematics provides many benefits, for example how to manage finances so that expenses do not exceed income. In this situation, numeracy skills are needed, even business people and entrepreneurs also manage their finances so that they do not experience losses, and in many other fields there are many more. The application of giving contextual questions can be applied as well as applying HOTS *(Higher Order Thinking Skills)* based mathematics questions.

According to Budiarta et al., (2018) stated that HOTS is meaningful as a complex thinking process consisting of the ability to describe material, criticize, and create alternative solutions to a problem. Meanwhile, Annuuru et al., (2017) revealed that HOTS is the ability in the process of analyzing, evaluating, and creating through a process of combining phenomena and an idea in the form of an evaluation of the facts that have been studied. Therefore, it can be concluded that HOTS is the ability to think complexly to combine facts and ideas that are used to analyze, evaluate, and create solutions to a problem.

Permendikbud No. 22 of 2016 concerning the Process of Primary and Secondary Education states that aspects of knowledge are obtained through the activities of remembering, understanding, applying, analyzing, evaluating, and creating. Based on Permendikbud No. 22 of 2016, there are 3 levels of assessment that interpret HOTS, namely analyzing, evaluating, and creating. Permana (2019), stated that HOTS is a question that requires a high level of thinking, critical and creative thinking in solving problems related to daily routines. According to Fanani (2018) Indonesian students cannot complete HOTS (Higher Order Thinking Skills) type questions carefully and correctly, so periodic research is needed in terms of analyzing student errors in completing HOTS *(Higher Order Thinking Skills)* type questions.

Errors can be interpreted as deviations from something that is true (Sulistio et al., 2019). Meanwhile, the opinion of Mauliandri (2020) states that an error is a form of deviation from the completion of a fixed job. From these two opinions it can be concluded that an error can be interpreted as a deviation related to a discrepancy in the determination of the completion of a job carried out by someone. Error analysis is a study related to student answers where there are errors in completing a subject matter (Siregar, 2019). Student errors in solving questions can be analyzed by looking at the results of the answers, so that later the type of error can be identified. In this case, the kastolan theory can be used as a reference for error analysis.

Kastolan theory can be used as an alternative for analyzing errors in answering math questions (Fajriyati Afdila, 2018). Kastolan theory errors are divided into three types, namely conceptual errors, procedural errors, and technical errors. Conceptual errors are errors in interpreting concepts, errors in determining the formula for solving a problem, and the use of formulas that do not meet the prerequisites for solving. Procedural errors are the incompatibility of the steps to solving the problem, and not being able to handle the steps of solving the problem. Meanwhile, technical errors are errors in the calculation process when solving a problem (Ayuningsih et al., 2020).

Research conducted by Mauliandri (2020) regarding the analysis of student errors in completing algebraic operations, revealed that there were 5 types of student errors, namely mistakes in determining variables, completing algebraic forms, operating negative symbols, and completing fractional forms. Then Fitriyah et al., (2020) also conducted research related

to the analysis of errors in answering Cartesian coordinate questions with kastolan theory revealing that 54.5% of students made conceptual errors, 27.3% of students made procedural errors, and 18.2% made technical errors. The same thing was also done by Najwa (2021) who stated that the things that caused mistakes were the lack of students' knowledge of the material and the lack of attention to the material presented. While this study intends to analyze student errors in solving circle math problems based on the kastolan theory.
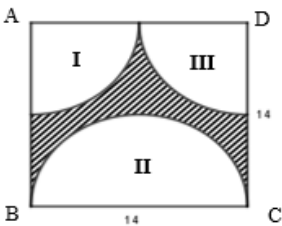
In accordance with the description above, there are still students who make mistakes when solving math problems. So, this study conducted research related to the analysis of types of student errors based on caste theory to see student errors included in conceptual, procedural, or technical errors. Then it will also be explored regarding the factors that cause errors, and the large percentage of student errors in completing questions. Different from previous studies, this study used circle material in class VIII in the form of HOTS *(Higher Order Thinking Skills)* questions.

METHODS

The method that will be used in this research is descriptive qualitative method. A qualitative approach is used to find out the causes of errors in answering questions. The purpose of this study was to describe the types of student errors in solving HOTS questions on circle material based on the kastolan theory. The subjects in this study were 13 students from class VIII A of SMP Negeri 4 Randublatung in semester 2 of the 2022/2023 academic year.

The research instrument consisted of written tests, interviews, and documentation. Prior to the identification process, students will be given 3 questions that have been validated by a team of experts with an allocated time of 90 minutes in table 1:

Table 1. HOTS Based Essay Questions

No	Question
1.	Mr. Ahmad has a square plot of land next to the house with a size of 14m×14m. The plan is that the land will be used for fish farming business. Where later a pond will be made that will be filled with three kinds of fish, pond I filled with tilapia, pond II filled with catfish and pond III filled with carp with a fish pond design as follows: In the design of land that is not shaded, a pond will be made, while the shaded is planned to be installed with ornamental grass. If the grass installation cost Rp.55.000/m^2, grass installers is Rp.100.000/person. So: a. Determine the circumference of the land to be covered with grass? b. Determine the total costs that must be prepared by Mr. Ahmad?
2.	Lala Bakery produces Maryam bread in the shape of a circle. Before baking the bread will be smeared with butter, each loaf has a diameter of 12 cm and every 120 cm^2 requires 2 grams of butter. If the butter used is sachet packaged butter, the weight of one sachet is 200 grams. If 600 loaves are sold every day, how many grams and how many sachets of butter are needed per day?
3.	One-day class VIIIA SMP Tunas Bangsa was teaching mathematics outside the classroom. The teacher gives students the task of determining the approximate length of the diameter of a large tree in their school garden. Lisa, Suga, Jiso, Rose and Jimin will calculate the approximate diameter of the tree by measuring the circumference of the tree. The method they use is to intertwine their fingers as shown in the picture

beside. Where the average fingertip length from right to left of students is 130 cm. If the five students touch each other's fingertips to surround the tree. Then determine the approximate diameter of the tree?

Reference source: (As'ari et al., 2017)

Data analysis techniques include data reduction, presenting data, and drawing conclusions (Annisa, 2023). The test has the objective of obtaining the location of the errors made by students based on castor theory. Furthermore, after giving the test, an analysis of student answers will be carried out based on the kastolan theory. Kastolan theory indicators according to Ulfa & Kartini (2021) are conceptual errors where the indicators consist of an inability to interpret terms, concepts, and principles, mistakes in choosing formulas, inability to apply formulas. The indicator procedural errors consist of incompatibility of problem solving steps, inability to solve problems down to the simplest form. While indicators of technical errors consist of errors in the counting process, and errors in moving numbers. Based on this opinion, the researcher intends to modify it into the following table:

Table 2. Kastolan Error Indicators

No	Error Type	Indicator
1	Conceptual Error	1. Misinterpreting the concept
		2. Incorrectly determine the formula for solving a problem
		3. The use of formulas that do not meet the prerequisites for formulas used in solving problems
2	Procedural Error	1. Incompatibility of the steps in solving the problem
		2. Unable to handle the steps in solving a problem
3	Technical Error	1. Made a mistake in the counting process

Reference source: (Ulfa & Kartini, 2021)

After analyzing the student's answer errors then, 3 samples of student answers will be taken which are grouped based on the types of conceptual, procedural, and technical errors. Interviews were conducted to strengthen information to make it more accurate and to explore factors that trigger students to make mistakes when solving problems. Meanwhile, documentation is used as evidence from archives of student answer sheets where there are errors in the steps of answering questions.

To calculate the percentage of student errors in answering questions, the following formula is used:

$$\text{Error percentage} = \frac{Number\ of\ students\ who\ made\ mistakes}{otal\ number\ of\ students} \times 100\%$$

The error percentage formula is used to find out what percentage of students make mistakes, which errors consist of conceptual, procedural, and technical errors.

RESULTS AND DISCUSSION

The research in class VIII A of SMP Negeri 4 Randublatung was conducted in 2 meetings with a total of 13 students. The first meeting was carried out by observing the process of delivering learning related to circle material. Meanwhile, at the second meeting students will be given 3 questions about HOTS *(Higher Order Thinking Skills)* based circle material descriptions. Then an analysis of the answers will be carried out, to obtain a recapitulation of the percentage of student errors based on castor error indicators. The results of data analysis are as follows:

Table 3. Recap of the Percentage of Student Errors

Question Number	Many Students Based on the Type of Error		
	Conceptual	Procedural	Technical
1	5	4	5
2	0	2	3
3	1	1	1
Percentage	46,15%	53,84%	69,23%

Table 3 is the result of a summary of the percentage of students who make mistakes based on castor theory. The results showed that the most dominant percentage of errors was technical errors in which there were 9 answers with a percentage of 69.23%. For procedural errors there were 7 student answers with a percentage of 53.84%. As for conceptual errors, there were 6 student answers with a percentage of 46.15%.

Conceptual Error

Based on table 2, conceptual errors are errors in interpreting concepts, errors in determining the solving formula, and the use of formulas that do not meet the prerequisites of the formula used. Then later the answers will be grouped based on the type of conceptual error and the percentage will be calculated for each question. The percentage of conceptual errors is as follows:

Table 4. Percentage of Conceptual Errors

Question Number	Number of Students	Percentage (%)
1	5	38,46%
2	0	0%
3	1	7,69%

Table. 4 describes the percentage of conceptual errors found in questions number 1 and 3 and the percentage. The following is a sample answer from S7:

Figure 1. Results of Answers to S7 Question Number 1b

Looking at the answers from S7 in figure 1 which made conceptual errors, interviews will be conducted to dig deeper into the factors that cause these errors. Following are the results of the interview with S7:

P : Try reading again what was asked about number 1b?

S7 : (Reading the questions) looking for the total cost that must be incurred by Mr. Ahmad

P	:	On your answer sheet there is a formula for finding the area of a circle, what is the formula?
S7	:	$2\pi^2$
P	:	Yesterday we discussed about circle formulas. Try to recall the formula for the area of a circle
S7	:	Yes, it should be π^2, if it's $2\pi^2$ to find the circumference of a circle

Based on the analysis of answers and interviews S7 it is known that the cause of the error is due to the use of formulas that do not meet the formula prerequisites, where the error includes conceptual errors. This is in line with the research conducted by Natsir et al (2016), conceptual errors, namely students' misapplication of concepts when solving problems. It can be seen in the answer of S7, students used a formula that did not meet the prerequisites for finding the area of a circle. This is because students write down the formula for the area of a circle $2\pi^2$ even though the formula for finding the area of a circle should be π^2 so that the answer to S7 is incorrect or wrong.
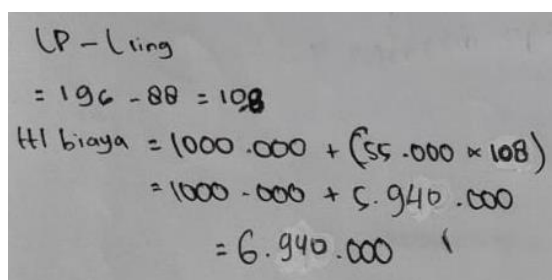
Procedural Error

Based on table 2, procedural error is a mismatch in the steps in solving the problem and not being able to handle the steps in solving the problem. Then later the answers will be grouped into the types of procedural errors and the percentage will be calculated for each question. The percentage of procedural errors is as follows:

Table 5. Percentage of Procedural Errors

Question Number	Number of Students	Percentage (%)
1	4	30,76%
2	2	15,38%
3	1	7,69%

Table. 5 describes the percentage of procedural errors found in questions number 1, 2, and 3 and the percentage. The following is a sample answer from S5:

Figure 2. Results of S5 Answers to Question Number 1b

Looking the answers from S5 in figure 2 who made procedural errors, interviews will be conducted to dig deeper into the factors that cause these errors. Following are the results of the interview with S5:

P   :   Try to look back at your work on question number 1b

S5   :   (See the answer sheet)

P   :   There is the area of the square minus the area of the circle, what value do you want to find?

S5   :   (Silent)

P   :   Let's try to remember again

S5   :   Oh yes sis I want to find the shaded area to calculate the total cost required

P   :   Okay, then why did you write it directly

S5   :   Hehe, yeah, I forgot

P   :   It is better if you write in a coherent manner the steps or procedures for solving the problem clearly. Yes, if i understand the answer you wrote

S5   :   Yes, so later I will write down the area of the shaded area equal to the area of the square minus the area of the circle?

P   :   Yes

Based on the analysis of answers and interviews with S5, it is known that the cause of the error is due to the inappropriateness of the steps in solving the problem, where the error is a procedural error. This is in line with research that has been conducted by Syafira & Zulkarnaen (2022) which states that it is said to be a procedural error when students cannot manipulate the steps of solving a problem. It can be seen in S5 answer that there is a discrepancy between the steps in solving the problem. Where students write directly the area of the square - the area of the circle, without writing down what to look for from the results of the calculation. This proves that students did not write down the steps of solving the problem in a coherent manner so that the student's answers were not systematically arranged.

Technical Error

Based on table 2, technical errors are errors in the counting process. Student answers will be grouped based on the type of technical error, then the percentage for each question will be calculated. The percentage of technical errors is as follows:

Table 6. Percentage of Technical Errors

Question Number	The number of students	Percentage (%)
1	5	38,46%
2	3	23,07%
3	0	0%

Table. 6 describes the percentage of technical errors found in questions number 1 and 2 and the percentage. The following is a sample answer from S19:

Figure 3. Results of Answers to S19 Question Number 2

Looking the answers from S19 in Figure 3 who made technical errors, interviews will be conducted to dig deeper into the factors that cause these errors. Following are the results of the interview with S19:

P	:	Do you think the answer to question number 2 is correct or not?
S19	:	(Silent)
P	:	Look at the results of calculating the area of a circle
S19	:	(See the answer sheet)
P	:	Try to read it again
S19	:	(Rereading answers)
P	:	That's 6 squared for 12, sure?
S19	:	That's right
P	:	Come on. 6 is squared, meaning 6 multiplied by 6
S19	:	Yes. 6 squared is 36, I was not careful yesterday

P : Yes, if 36 then what is the answer?

S19 : (Recount) the answer is 113.04

Based on the analysis of answers and interviews with S19, it is known that the cause of the error is due to the lack of accuracy of the students in the process of calculating exponentials where the error is a technical error. This is in line with research conducted by Fitriatien (2019) which states that technical errors are errors made due to students' lack of accuracy in calculating which results in wrong answers. It can be seen in the answers to S19, the students made the wrong calculations. From the answers of students who assume that $6^2 = 12$ with the assumption that 6^2 is 6×2, even though 6^2 should be 36 because $6 \times 6 = 36$. With the rank error causing the student's final answer to be wrong.

From the results of calculating the percentage of errors in table 3, the most dominant errors are technical errors with a percentage of 69.3%. This is in line with research from Rahmawati et al., (2021) which revealed that the most dominant error lay in technical errors with a percentage of 43.9% where the subject made an error in the multiplication arithmetic operation.

CONCLUSION

Based on the results of research on error analysis using kastolan theory in solving HOTS questions on circle material at class VIII A of SMP Negeri 4 Randublatung. It can be concluded that the most dominant errors occur in technical errors where errors are made in the counting process with a percentage of 69.23%. Student procedural errors were made due to the incompatibility of the steps in solving the questions which resulted in wrong answers, with a percentage of 53.84%. Students' conceptual errors were made because students misinterpreted concepts and incorrectly determined the problem solving formula, with a percentage of 46.15%. Factors that cause students to make mistakes in solving HOTS-based questions are: students are not careful in the process of calculating ranks, use of formulas that do not meet the prerequisites of the formula, and incompatibility of steps in solving problems.

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REFERENCES

Annisa, I. S. (2023). *Analisis Faktor Penyebab Kesulitan Siswa dalam Pembelajaran Tematik dengan Menggunakan Metode Miles dan Huberman di Kelas IV SD Negeri 060800*. *3*, 6469–6477. https://doi.org/https://doi.org/10.31004/innovative.v3i2.1130

Annurwanda, P., & Friantini, R. N. (2019). Efektivitas Penerapan Round Table dan Ekspositori Terhadap Prestasi Belajar Matematika Ditinjau dari Kemampuan Awal. *RIEMANN*, *1*(1), 1–13. https://doi.org/https://doi.org/10.38114/riemann.v1i1.19

Annuuru, T. A., Johan, R. C., & Ali, M. (2017). Peningkatan Kemampuan Berpikir Tingkat Tinggi dalam Pelajaran Ilmu Pengetahuan Alam Peserta Didik Sekolah Dasar Melalui Model Pembelajaran Treffinger. *Edutcehnologia*, *3*(2), 136–144.

As'ari, A. R., Mohammmad, T., Valentino, E., Taufik, I., & Zainul, I. (2017). *Matematika Kelas VIII SMP/MTs Semester II*. Jakarta: Kementriani Pendidikan dan Kebudayaan.

Ayuningsih, R., Setyowati, R. D., & Utami, R. E. (2020). Analisis Kesalahan Siswa dalam Menyelesaikan Masalah Program Linear Berdasarkan Teori Kesalahan Kastolan. *Imajiner: Jurnal Matematika Dan Pendidikan Matematika*, *2*(6), 510–518. https://doi.org/10.26877/imajiner.v2i6.6790

Budiarta, K., Harahap, M. H., Faisal, & Mailani, E. (2018). *Potret Implementasi Pembelajaran Berbasis High Order Thinking Skills (HOTS) di Sekolah Dasar Kota Medan*. *January*.

Fajriyati Afdila, N. (2018). Analisis Kesalahan Siswa Dalam Menyelesaikan Masalah Kontekstual Materi Bangun Ruang Sisi Datar Berdasarkan Tahapan Kastolan. *Jurnal LEMMA*, *5*(1), 65–72. https://doi.org/10.22202/jl.2018.v5i1.3383

Fanani, M. Z. (2018). Strategi Pengembangan Soal Hots Pada Kurikulum 2013. *Edudeena*, *2*(1), 57–76. https://doi.org/10.30762/ed.v2i1.582

Fauzy, A., & Nurfauziah, P. (2021). Kesulitan Pembelajaran Daring Matematika Pada Masa Pandemi COVID-19 di SMP Muslimin Cililin. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *5*(1), 551–561. https://doi.org/10.31004/cendekia.v5i1.514

Fitriatien, S. R. (2019). Analisis Kesalahan dalam Menyelesaikan Soal Cerita Matematika Berdasarkan Newman. *Jurnal Ilmiah Pendidikan Matematika*, *1*(2), 1–12.

https://doi.org/10.36706/jls.v1i2.9707

Fitriyah, I. M., Pristiwati, L. E., Sa'adah, R. Q., Nikmarocha, N., & Yanti, A. W. (2020). Analisis Kesalahan Siswa dalam Menyelesaikan Soal Cerita Koordinat Cartesius Menurut Teori Kastolan. *Al-Khwarizmi: Jurnal Pendidikan Matematika Dan Ilmu Pengetahuan Alam*, *8*(2), 109–122. https://doi.org/10.24256/jpmipa.v8i2.1002

Mauliandri, R. & K. (2020). Analisis Kesalahan Siswa Menurut Kastolan dalam Menyelesaikan Soal Operasi Bentuk Aljabar pada Siswa SMP. *Jurnal Pendidikan Dan Matematika*, *09*(2), 107–123. https://doi.org/http://dx.doi.org/10.30821/axiom.v9i2.7687

Najwa, W. A. (2021). Analisis Kesalahan Siswa dalam Menyelesaikan Penjumlahan Bilangan Bulat Berdasarkan Teori Kastolan. *Jurnal Sekolah Dasar*, *6*(1), 77–83. https://doi.org/10.36805/jurnalsekolahdasar.v6i1.1288

Natsir, N., Tandiayuk, M. B., & Karniman, T. S. (2016). Profil Kesalahan Konseptual dan Prosedural Siswa dalam Menyelesaikan Soal Cerita Himpunan di Kelas VII SMPN 1 Siniu. *Jurnal Elektronik Pendidikan Matematika Tadulako*, *03*(04).

Novitasari, N., & Wilujeng, H. (2018). Analisis Kemampuan Pemecahan Masalah Matematika Siswa Smp Negeri 10 Tangerang. *Prima: Jurnal Pendidikan Matematika*, *2*(2), 137. https://doi.org/10.31000/prima.v2i2.461

Permana, N. N. (2019). Analisis Kesalahan Siswa dalam Menyelesaikan Soal Higher Order Thinking Skills (HOTS) Matematika. *Diskusi Panel Nasional Pendidikan Matematika*, *5*(50), 19–24.

Rigusti, W., & Pujiastuti, H. (2020). Analisis Kemampuan Pemecahan Masalah Ditinjau Dari Motivasi Belajar Matematika Siswa. *Prima: Jurnal Pendidikan Matematika*, *4*(1), 1. https://doi.org/10.31000/prima.v4i1.2079

Siregar, H. M. (2019). Analisis Keslahan Siswa dalam Menyelesaikan Soal Tes Kemampuan Berpikir Kreatif Matematis Materi Lingkaran. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *8*(3). https://doi.org/10.24127/ajpm.v8i3.2379

Sulistio, W., Muhsetyo, G., & Qohar, A. (2019). Klasifikasi Kesalahan Siswa Kelas VII menggunakan Model KIAT tentang Materi Himpunan. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, *4*(6), 706. https://doi.org/10.17977/jptpp.v4i6.12477

Suyitno, A., & Kristiyajati, A. (2016). *Guru Pembelajar Modul Matematika SMA:Kelompok Kompetensi E Strategi Pembelajara 2, Pengembangan Indikator dan Materi*.

Syafira, D. R. 'Aisy, & Zulkarnaen, R. (2022). Analisis Kemampuan Komunikasi Matematis Siswa Berdasarkan Teori Kastolan. *Biormatika : Jurnal Ilmiah Fakultas Keguruan Dan Ilmu Pendidikan*, *8*(1), 84–92. https://doi.org/10.35569/biormatika.v8i1.1225

Ulfa, D., & Kartini, K. (2021). Analisis Kesalahan Siswa dalam Menyelesaikan Soal Logaritma Menggunakan Tahapan Kesalahan Kastolan. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *5*(1), 542–550. https://doi.org/10.31004/cendekia.v5i1.507