



Analysis of Students' Difficulties in Solving Function Composition Problems

Erni Maidiyah, Maya Shopiani Hasibuan, Mailizar Mailizar, and Fahlida Harnita

Department of Mathematics Education, Universitas Syiah Kuala, Banda Aceh, Indonesia

ernimaidiyah@unsyiah.ac.id

Abstract. Many students experience difficulty in solving function composition problems. The aims of this study were (1) to find out the difficulties experienced by students in solving function composition problems, and (2) to find out why students experienced difficulties in solving function composition problems. This research is qualitative research which involved six students in grade X. Data was collected by test and interview with the researcher as main instrument and essay test and interview guidelines as supporting instruments. Data was analyzed through three stages, namely reducing data, presenting data and drawing conclusions. Data validity through method triangulation. The results of this study are that students experience difficulties in understanding the concept and applying the principle. The causes of students having difficulty in solving function composition problems are lack of mastery of the concept and knowledge of function composition material, lack of accuracy in substituting x values, students are not used to problems that are different from the example problems, lack of students' confidence to ask the teacher, students lack motivation in learning mathematics and are not interested in paying attention to the lessons explained by the teacher, and students never repeat or re-study the material.

Keywords: Function Composition, Mathematics Problem Solving, Students' Difficulties

1 Introduction

Education is an effort to develop one's abilities. Education has a very important role in various aspects of life. For example, in a country, education is very important because it can make the country continue to progress and develop. Good education can improve the quality of the nation for the better so that in the future a good quality country will be created too.

In Indonesia, currently education cannot be said to be good. One element of education is mathematics and through TIMSS (Trends in International Mathematics and Science Study) in 2015 it was shown that Indonesia's average score was 397, making Indonesia ranked 46th out of 51 countries [1]. Based on this, it can be said that education in Indonesia is not good, one of the reasons is because the students' mathematical abilities are still low.

One of the reasons is that students' low mathematics abilities are because many students don't like mathematics and think mathematics is very difficult to understand.

The fact that studying mathematics is very useful for everyday life still cannot eliminate the opinion of some students that mathematics is difficult, and many students still avoid mathematics. This is why we are not surprised that students' mathematical abilities in Indonesia are still very low.

Basically, satisfactory abilities can be achieved by each student if the student can learn naturally. In reality, apart from students who don't like mathematics and think mathematics is difficult, certain students also still experience obstacles and disruptions in learning mathematics, which makes it difficult for them when they want to study mathematics. Students' difficulties in learning mathematics can be identified one way by looking at the number of students experiencing difficulty in solving problems using mathematics material, indicated by the number of mistakes students make when solving these problems. In line with this, [2] stated that there were several difficulties experienced by students in solving problems on function composition and inverse function material, namely difficulty understanding the concept, difficulty interpreting sentences in the problem, difficulty understanding the content of the problem, difficulty mastering the concept of using composition. and inverse, as well as students' lack of accuracy when working on the problems given. Apart from that, [3] stated that there were several difficulties experienced by students in solving problems on function material, namely students were not able to write down what they knew and were asked according to what the problem asked for, students had not yet mastered function material, as well as students' lack of accuracy in calculation operations. Apart from that, [4] stated that there were difficulties experienced by students in solving trigonometric comparison problems, namely: (1) difficulty in stating definitions (2) difficulty in understanding basic concepts and using the principle of related angles, (3) difficulty in understanding words. the words in the problem and formulate the next solution steps.

Difficulty in solving mathematics material problems cannot be separated from several factors that cause it. In line with this, [5] stated that the cause of the difficulties experienced by students when solving pyramid problems was because the students did not fully understand the pyramid material. Apart from that, [6] stated that the causes of difficulties experienced by students when solving problems on SPLDV material were due to lack of mastery of SPLDV material, lack of perseverance, lack of thoroughness when working on problems, and not mastering SPLDV concepts and principles.

Based on the Education Assessment Center of The Ministry of Education and Culture from 2017 to 2019, it shows that one of the materials that is difficult for students to complete is function composition material [7]. Function composition material is material taught to high school students in class X, precisely in the even semester. In fact, studying the function composition material well is very useful if applied in everyday life, for example by using color compositions, printing machines can produce new colors. And there are various problems in everyday life that can be solved using the function composition, but based on this data it is clear that there are still many students who have difficulty solving problems about the function composition. One of them is a student at SMA Negeri 5 Banda Aceh. This data shows that in 2017 high school students completed problems about function compositions correctly at 27.08 percent, it is known that this value is still far from the minimum percentage value, namely 55.00 percent. Furthermore, in 2018 students at high school solved problems about function compositions correctly by 22.30 percent. Finally, in 2019, the data showed that only 15.11 percent of high school students solved problems about function

compositions correctly. Based on these three data, it can be seen that at SMA Negeri 5 Banda Aceh, students' learning outcomes in function composition material have decreased.

Based on the descriptions above, researchers are motivated to identify more deeply the difficulties experienced by students when solving function composition problems and the causes of these difficulties. So, the aim of this research is to find out the difficulties experienced by class X students in solving function composition problems and causes of students' difficulties in solving function composition problems.

2 Methode

This research applied a descriptive qualitative approach. Research subjects were determined using purposive sampling with the consideration that these subjects were most likely to obtain the desired information. The research subjects were selected through a test taken by 31 class X students at one of the high schools in Banda Aceh City. Next, the researchers took 6 students who made the most mistakes when completing the test to become research subjects.

Research data was collected through tests and interviews. There are two instruments, namely the main and supporting instruments. The main instrument is the researcher himself. Researchers become planners and reporters of research results. Then the supporting instruments are test problems and interview guidelines. The test problems consist of three problems with the type of description on the function composition material which was designed by researchers and has been tested for validity. Giving tests in the form of descriptive problems is intended to be able to see students' stages when solving problems in such a way that it can make it easier for researchers to analyze students' difficulties. The test was carried out for 45 minutes. After carrying out the test, the six students who made the most mistakes in completing the test were involved as interview subjects. In this research, interviews were conducted in an unstructured manner so that the implementation was freer and made the subject more open. Interviews were conducted to confirm what difficulties they were experiencing. The interview guide contains problems regarding the steps students take when solving problems and students' difficulties when solving problems and the causes of these difficulties.

In this research, data was analyzed using three techniques, namely data reduction, data presentation, and drawing conclusions. At the data reduction stage, the activities carried out were 1) correcting students' answers and determining the interview subject; 2) transforming test results into notes for interview material; 3) conduct interviews; 4) transcribe the subject's answers during the interview; 5) selecting interview data by discarding or setting aside parts that are not needed; and 6) rechecking the transcript by listening to the interview recording again to reduce errors in the transcript. At the data presentation stage, the researcher presents test data in tabular form and other data in narrative form. Next, at the conclusion drawing stage, researchers categorized students' difficulties into two types of difficulties, namely difficulties in understanding concepts and difficulties in applying principles. Students are said to have difficulty understanding the concept of function composition if 1) they are unable to define what is meant by function composition; 2) unable to understand the rules of function

composition; 3) cannot remember the terms that represent the function composition; 4) cannot remember one or more conditions that the object requires with the terms that represent it; 5) unable to provide examples of function compositions; and 6) cannot distinguish examples from non-examples of the function composition. Students are said to have difficulty in applying the principle of function composition if 1) they are unable to carry out discovery activities about something; 2) less careful when calculating or algebraic operations; 3) unable to determine relevant factors, resulting in an inability to abstract patterns; 4) unable to apply the function composition formula; and 5) able to state a principle, but not the meaning and how to use it.

In this research, researchers used triangulation methods, namely collecting data using several methods. The triangulation method used in this research is that the researcher checks the validity of the data by comparing student test results with interviewer results. This triangulation method is carried out to minimize researcher errors when drawing conclusions.

3 Result and Discussion

This research was conducted to describe the difficulties experienced by students in solving function composition problems and also to determine the causes of students experiencing these difficulties. The researcher explained the data from this research in the form of data descriptions from test results and interviews.

The test results show that in problem number 1a there were 29 students who answered correctly with a percentage of 93.6%, students whose final answer was correct but the solution step was wrong was one student with a percentage of 3.2%, and students who got the wrong answer was one student with a percentage of 3.2%. In problem number 1b there were 23 students who answered correctly with a percentage of 77.42%, 6 students whose final answer was correct but were wrong in the solution step with a percentage of 16.13%, and 2 students whose answer was wrong were students with a percentage of 6.45%. In problem number 2 and problem number 3, no students answered correctly and it is known that all students answered incorrectly in problem number. For problem number 2, there were only a few students who only wrote what they knew and were asked, whereas for problem number 3, most students left their answers blank. From this it is very clear that overall students had great difficulty in solving the problems given, especially in problems number 2 and number 3.

Of the 31 students who took the test, several students indicated that they experienced different difficulties with each problem item. Based on the students' answer sheets, it is known that in general the difficulties experienced by students are 1) not being able to understand the rules of function compositions; 2) difficulty in determining the function composition of two given functions; 3) difficulties in applying the function composition formula; 4) difficulty in determining the value of the function composition; 5) difficulty in substituting the value of x ; 6) difficulty in algebraic fraction calculation operations; 7) students don't know what to look for; and 8) students cannot answer the problems.

Based on the types of difficulties above, there were six students who were indicated to have experienced the most difficulty in solving the problems, which was indicated by the number of errors they made in solving the problems given, so the researcher took these six students to be research subjects so they could be interviewed. Students who are declared to have made the most mistakes here mean students whose answers are

wrong, students whose final answer is correct but the solution steps are wrong, students whose writing is known and only asked and students who don't answer the problem at all. Below are the results of tests and interviews with research subjects to find out more about the difficulties they experienced.

Description of Students' Difficulties in Solving Problem Number 1a

In problem number 1a, subject S14's final answer was correct, but in the solution steps it was discovered that the operation carried out was not in line with the results obtained. This can be seen based on subject S14's lack of accuracy in substituting $x = 4x + 11$ into the function $f(x) = \frac{5x+10}{2x+4}$ to find the results of $(f \circ g)(x)$. In the next line, subject S14 also appears to have made a mistake in determining the result of $5(4x + 11) + 10$. Subject S14 wrote down that $5(4x + 11) + 10$ is equal to $2(4x + 11) + 4$, even though it should be $20x + 55 + 10$. For more details, see the answer sheet for subject S14 for problem number 1a in Fig 1.

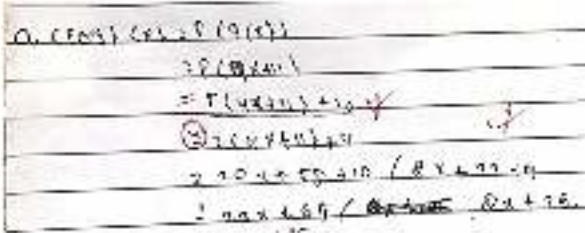


Fig. 1. Student's answer sheet for problem number 1a.

The following is an excerpt from the researcher's interview with subject S14 regarding problem number 1a:

P : Take a look at problem number 1a, what do you understand from that problem?

S14 : $f(x) = \frac{5x+10}{2x+4}$ and $g(x) = 4x + 11$ are known, then look for $(f \circ g)(x)$.

P : Then look at your answer sheet for problem number, why did you write it down as $f(4x + 11) = 5(4x + 11) + 10$?

S14 : I don't know.

P : For example, to determine $(f \circ g)(x)$ from problem 1a, what was the first step you took?

S14 : I don't know, I saw it from a friend.

P : What do you know about the function composition?

S14 : I don't remember too much, sister.

P : For example, in general, what is the function composition known as?

S14 : I don't know.

P : Why didn't you know? Hasn't this material already been taught by a teacher?

S14 : Yes, it has, but I don't understand the material, sis.

P : Why don't you understand? And if you don't understand, why not ask the teacher to explain it again?

S14 : I don't dare to ask, sis.

P : Then try to look at the next line, regardless of whether you look at your friend's answer sheet, do you know why is $5(4x + 11) + 10$ equal to $2(4x + 11) + 4$ and $2(4x + 11) + 4$ equal to $\frac{20x+55+10}{8x+22+4}$?

S14 : I forgot to draw the line, bro. It should be above that $\frac{5(4x+11)+10}{2(4x+11)+4}$.

P : So, what is $\frac{5(4x+11)+10}{2(4x+11)+4}$ then?

S14 : This one, Sis (While pointing to the answer sheet), $\frac{20x+55+10}{8x+22+4}$ Sis.

Based on the answer sheet, subject S14 seems to have difficulty in determining the results $f(4x + 11)$. This is in line with the interview excerpt above which shows that subject S14 experienced difficulty and difficulty in understanding the function composition material, subject S14 did not know what is meant by function composition and subject S14 also could not remember the terms that represent function composition, causing subject S14 to not can determine the outcome of $f(4x + 11)$. Based on the answer sheet and interview results, it can be said that in problem number 1a subject S14 had difficulty understanding the concept of compositional function.

Description of students' difficulties in solving problem number 1b

In problem number 1b, subject S7 seemed to have difficulty in providing the next solution step after $(gof)(x) = \frac{20x+40+22x+44}{2x+4}$ and also cannot determine the value of $(gof)(2)$. He has difficulty substituting values $x = 2$ into the function $(gof)(x) = \frac{20x+40+22x+44}{2x+4}$. The answer sheet for subject S7 for problem number 1b can be seen in Fig. 2.

The image shows a student's handwritten work on lined paper for problem 1b. The work is as follows:

$$\begin{aligned} \text{b. } (gof)(x) &= g(f(x)) \\ &= g\left(\frac{5x+10}{2x+4}\right) \\ &= 4\left(\frac{5x+10}{2x+4}\right) + 11 \\ &= \frac{20x+40}{2x+4} + 11 = \frac{20x+40+11(2x+4)}{2x+4} \\ &= \frac{20x+40+22x+44}{2x+4} \end{aligned}$$

Fig. 2. Student's answer sheet for problem number 1b.

The following is an excerpt from the researcher's interview with subject S7 for problem number 1b:

P : What do you understand from problem number 1b?

S7 : Look for $(gof)(2)$ from functions $f(x)$ and $g(x)$ which is known in this problem.

P : Take a look at your answer sheet for problem number 1b, why don't you continue with the steps for solving problem number 1b?

S7 : I don't know how to do $(gof)(2)$.

P : Why didn't you know? Hasn't this material already been taught by a teacher?

S7 : Yes, Sis, but I don't really understand the function composition. I just remember that $(gof)(x) = g(f(x))$, Sis.

P : What do you not understand from doing $(gof)(2)$?

S7 : I don't know why there is 2 in $(gof)(2)$.

P : If you do $(gof)(x)$, do you understand?

S7 : I don't really understand, Sis, because it's difficult, Sis, there's a fraction there.

P : So, try to explain what is meant by function composition?

S7 : Addition and subtraction of fractions, that's how you enter the value (gof) and there will be a set later.

P : Are you sure that is what is meant by the function composition?

S7 : I think that is it, Sis.

Based on the answer sheet, it can be seen that subject S7 cannot continue the completion steps to determine the results $(gof)(2)$. This is also relevant to the interview results which show that subject S7 does not master the function composition material well. Subject S7 was unable to explain what is meant by function composition correctly and function $(g)(x)$ and $(f)(x)$ given in the form of algebraic fractions, making it difficult for subject S7 to determine $(gof)(x)$. Subject S7 knows that $(gof)(x) = g(f(x))$. However, subject S7 did not really understand the meaning of the statement. Subject S7 was also unable to determine the value $(gof)(2)$ because he didn't understand the meaning of $(gof)(2)$. Based on the answer sheet and interview results, it can be said that subject S7 experienced difficulties in understanding concepts as well as difficulties in applying principles.

Description of students' difficulties in solving problem number 2

In problem number 2, subject S9 wrote back what he knew and was asked in the problem and then answered just by writing $(f \circ g)(x) = f(g(x))$ without providing the next solution steps. For more details, the answer sheet for problem number 2 subject S9 can be seen in Fig. 3.

2. Dik : $(F \circ g)(x) = 4x^2 - 1$,
 $F(x) = 2x + 5$,
 Dit : $g(x-5)$,
 jawab :
 $(F \circ g)(x) = F(g(x))$,
 ' f c

Fig. 3. Student's answer sheet for problem number 2.

The following is an excerpt from the researcher's interview with subject S9 regarding problem number 2:

P : Next, try to pay attention to your answer sheet for problem number 2, why did you only write it down $(f \circ g)(x) = f(g(x))$ without providing the next solution steps?

S9 : Because I don't know how to do it, Sis.

P : Why did you not know?

S9 : Because it's difficult, Sis.

P : How difficult is it?

S9 : It's difficult because I don't know what to do first to do $g(x)$. In the problem, $g(x)$ unknown. I've also forgotten the material, Sis.

Based on the answer sheet, subject S9 had difficulty determining function $g(x)$. This is reinforced by the interview excerpt above, which shows that subject S9 is unable to apply the function composition formula and is unable to carry out discovery activities about determining $g(x)$. Subject S9 admitted that he did not know the first step he had

to take to determine function $g(x)$. Based on the answer sheet and interview results, it can be said that subject S9 experienced difficulty in applying the principles.

Description of students' difficulties in solving problem number 3

In problem number 3, all students just left their answer sheets blank without writing what they knew or filling in their answer sheets with their knowledge. In other words, all students cannot answer and complete the problems. From this, it can be seen that students do not understand the function composition material well.

The following is an excerpt from the researcher's interview with subject S28 regarding the causes of the difficulties experienced:

P : What number of problems do you think are the most difficult to do?

S28 : Problem number 2 and 3, Sis.

P : Why do you find these two numbers difficult?

S28 : It's a little difficult to do, sis, maybe because I've forgotten the material, sis. In my opinion, number 2 is like the opposite of number 1, sis, regarding number 2 it is unknown $g(x)$ so I don't understand how to do it.

P : What do you think about problem number 3?

S28 : Number 3 was done, but the results were a bit uncertain so it wasn't written on the answer sheet. Because in my opinion the problem is almost the same as problem number 1b.

P : How do you understand problem number 3?

S28 : Just like problem number 1b, first we do $(gof)(x)$ then look for the value a . But I'm confused about how to find the value a , Sis, because there are the same as 4.

P : Then, that means you only understand until you determine $(gof)(x)$, right?

S28 : Yes, Sis.

P : What do you think about the three problems given?

S28 : The problems differ slightly in level of difficulty from those taught by our teacher. When our teacher taught us the problems were not the same as the problems my brother gave us. Usually the problem doesn't have fractions like the problem above, Sis.

P : Do you like mathematics?

S28 : I like it, Sis.

P : If you don't understand something, have you ever asked the teacher?

S28 : Quite often, Sis.

P : Have you ever repeated or re-studied function composition material at home?

S28 : No, Sis.

Through the interview excerpt above, it can be seen that the difficulties experienced by subject S28 in solving the problems given were because subject S28 had not fully mastered the function composition material, rarely worked on varied problems or other problems that were different from those given by the teacher, and also because Subject S28 never studied function composition material again, so he did not fully remember the material.

Based on student test results, it is known that almost all students experience difficulty in solving the problems given. Based on the results of the tests and interviews that have been conducted, it can be seen that the function composition material is considered difficult material for students. Some students admitted that they did not understand the function composition material and when asked to explain or define what is meant by function composition, the answers given by students varied according to what they knew and some were even unable to answer. Some students also admitted

that they were not able to solve the function composition test problems given and still made many mistakes in the completion steps to answer the problems. and there are also students who admit that they still don't understand the concept of fractions, especially when students have to equate the denominators of algebraic fractions. This is due to the difficulties experienced by students in solving the problems that have been given.

Based on research that has been conducted, researchers found that the types of difficulties experienced by students in solving function composition problems were difficulties in understanding concepts and difficulties in applying principles. Based on the tests carried out, the difficulties experienced by this student made the test results less than satisfactory. This is in accordance with Cooney's opinion [8], namely that difficulty using concepts and using principles is a learning difficulty that influences student learning outcomes.

This finding is in line with the results of previous research conducted by [3] which revealed that one of the difficulties experienced by students in solving function composition and inverse function problems was difficulty in learning concepts. And the results of this research are also in line with the results of research conducted by [2] which states that one of the difficulties students have in solving function composition problems is difficulty in understanding the concept.

This finding is in line with the research results of [3] which revealed that one of the difficulties experienced by students in solving problems was difficulty in applying principles. And the results of this research are also in line with the results of research conducted by [2] which states that difficulties in applying principles make students experience difficulties in solving problems.

Based on interviews that have been conducted, there are several factors that cause students to experience difficulties in solving the problems given, namely as follows. *First*, a low level of intelligence is one of the causes of students' difficulty in solving the problems given. When the teacher is explaining material, students who have a low level of intelligence will likely find it difficult to accept and understand the explanation, which can cause them to experience higher learning difficulties. *Second*, material that is difficult to understand. There are still many students who experience difficulties in understanding and mastering the function composition material. Agrees with [9] who said that one of the causes of students having difficulty answering problems is material that is difficult to understand. This finding is also in line with the research results of [10] which revealed that one of the factors causing students to experience difficulty in solving problems is a lack of mastery of the material. In other hand, [11] revealed that one of the causes of students' difficulty in solving problems is a lack of practice in solving problems. *Third*, students' attitudes towards learning. Students' attitudes when studying mathematics, for example, are easily discouraged, indifferent, their attention is not focused on mathematics lessons, and other inappropriate attitudes can cause them to experience many difficulties learning mathematics, especially in solving problems [12]. *Fourth*, students' laziness. Students' laziness in studying hard and persistently and not wanting to repeat at home the lessons they have been taught at school can cause students to have difficulty understanding the material. This is in line with the research results of [13] which revealed that one of the factors causing students to experience difficulties in solving problems is the students' lack of perseverance in studying. *Fifth*, motivation to learn. Students who have low motivation in learning mathematics will make them less enthusiastic about learning and not interested in paying attention to the lessons explained by the teacher, which can result in these students having difficulty learning mathematics, especially in answering problems [14]. *Sixth*, interest in learning. Lack of interest in mathematics lessons can cause learning difficulties. This is in line

with the research results of [15] which revealed that one of the factors causing students to experience difficulty in solving problems is students' lack of interest in learning. It is known that there are still many students who do not have a high interest in studying mathematics. The reason that is often found is because they really don't like mathematics subjects and think mathematics is difficult and they prefer other subjects. *Seventh*, lack of student accuracy when solving problems. One of the mistakes that students often make is not being careful in solving the problems given. There are students who understand the function composition material but in solving the problems they are not careful enough and there are several errors in the steps in solving the problems. Especially in adding fractions in algebraic form. Some students were also in a hurry to complete the problems and did not check the answer sheets again before submitting them. This is in line with the results of research by [16] which revealed that one of the factors causing students to experience difficulties in solving problems is that they are not careful when working on problems so that many students make mistakes when carrying out elimination, substitution and algebraic operations in addition and subtraction. This is also in line with the research results of [17] which stated that one of the reasons why students find it difficult to solve problems is because students are not careful in solving problems that have a lot of arithmetic operations in them.

Based on the interviews that have been conducted, it can also be seen that the main reason students experience difficulties in solving the problems given is because students do not fully understand the function composition material and students never repeat or re-study the function composition material.

4 CONCLUSION

Based on the results of the data analysis and discussion above, it can be concluded that the difficulties experienced by students in solving function composition problems are difficulties in understanding the concept namely the inability to determine the composition of the two functions given and to substitute the value of x , and difficulties in applying the principle namely the lack of accuracy in adding algebraic forms, and the inaccuracy in substituting the value of x . The causes of students having difficulty in solving function composition problems are lack of mastery of the concept and knowledge of function composition material in the form of understanding, lack of accuracy of students in substituting x values, students are not used to problems that are different from the example problems in the book or given by the teacher, lack of students' confidence to ask the teacher, students lack motivation in learning mathematics and are not interested in paying attention to the lessons explained by the teacher and students never repeat or re-study the material.

References

- [1] "TIMSS 2015 and TIMSS Advanced 2015 International Results – TIMSS Reports." <http://timssandpirls.bc.edu/timss2015/international-results/>
- [2] B. Susanti and Y. A. P. Lestari, "Analisis kesulitan siswa kelas XI dalam menyelesaikan soal fungsi komposisi dan fungsi invers di SMK Al-Ikhsan Batujajar," *Journal of Education*, vol. 1, no. 3, pp. 446–459, Apr. 2019, doi: <https://doi.org/10.31004/joe.v1i3.189>.

- [3] A. Kurniawan, E. Juliangkary, and M. Y. Pratama, "Analisis kesulitan siswa dalam menyelesaikan soal fungsi," *Media Pendidikan Matematika*, vol. 7, no. 1, p. 72, Jul. 2019, doi: <https://doi.org/10.33394/mpm.v7i1.1679>.
- [4] T. Subroto and W. Sholihah, "Analisis hambatan belajar pada materi trigonometri dalam kemampuan pemahaman matematis siswa," *IndoMath: Indonesia Mathematics Education*, vol. 1, no. 2, p. 109, Aug. 2018, doi: <https://doi.org/10.30738/indomath.v1i2.2624>.
- [5] A. C. S. Manalu, S. Manalu, and L. S. Zanthly, "Analisis kesulitan siswa SMP kelas IX dalam menyelesaikan soal materi lingkaran," *Jurnal Cendekia: Jurnal Pendidikan Matematika*, vol. 4, no. 1, pp. 104–112, Feb. 2020, doi: <https://doi.org/10.31004/cendekia.v4i1.179>.
- [6] B. B. Dini, S. Amsikan, and O. Mamoh, "Analisis kesulitan siswa dalam menyelesaikan soal cerita materi sistem persamaan linear dua variabel siswa SMP Negeri Kateri," *Math-Edu: jurnal ilmu pendidikan matematika*, vol. 4, no. 2, pp. 44–50, Aug. 2019, doi: <https://doi.org/10.32938/jipm.4.2.2019.44-50>.
- [7] "Pusat Asesmen Pendidikan," *Kemdikbud.go.id*, 2022. <https://pusmendik.kemdikbud.go.id/>
- [8] T. Rukhmana, "Analisis kesulitan belajar siswa dalam mempelajari aljabar pada kelas VIII SMP Negeri 2 Kerinci," *Journal of Didactic Mathematics*, vol. 1, no. 1, pp. 53–57, Apr. 2020, doi: <https://doi.org/10.34007/jdm.v1i1.160>.
- [9] I. Zulaika, S. Sutarto, and B. R. Ayu Febrilia, "Analisis kesulitan siswa dalam menyelesaikan soal operasi hitung bentuk aljabar pada siswa kelas VIII MTs Negeri 2 Lombok Tengah ditinjau dari peta kognitif," *JPN: Jurnal Pendidik Indonesia*, vol. 2, no. 2, pp. 37–42, Oct. 2019, doi: <https://doi.org/10.47165/jpin.v2i2.75>.
- [10] N. W. J. Lestari and M. Afrilianto, "Analisis kesulitan siswa smp dalam menyelesaikan soal cerita pada materi sistem persamaan linear dua variabel melalui pembelajaran daring," *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, vol. 4, no. 5, pp. 1105–1112, Sep. 2021, doi: <https://doi.org/10.22460/jpmi.v4i5.p1105-1112>.
- [11] A. P. Kusuma and S. F. Adna, "Analisis kesulitan siswa dalam menyelesaikan soal Higher Order Thinking Skill (HOTS) sistem persamaan linear dua variabel," *Jurnal Sainika Unpam : Jurnal Sains dan Matematika Unpam*, vol. 3, no. 2, p. 150, Jan. 2021, doi: <https://doi.org/10.32493/jsmu.v3i2.8674>.
- [12] S. Hashim, A. Masek, B. N. S. M. Mahthir, A. H. A. Rashid, and D. Nincarean, "Association of interest, attitude and learning habit in mathematics learning towards enhancing students' achievement," *Indonesian Journal of Science and Technology*, vol. 6, no. 1, pp. 113–122, Jan. 2021, doi: <https://doi.org/10.17509/ijost.v6i1.31526>.
- [13] R. Jiang *et al.*, "How mathematics anxiety affects students' inflexible perseverance in mathematics problem-solving: Examining the mediating role of cognitive reflection," *British Journal of Educational Psychology*, vol. 91, no. 1, Jun. 2020, doi: <https://doi.org/10.1111/bjep.12364>.
- [14] J. Jufrida, W. Kurniawan, A. Astalini, D. Darmaji, D. A. Kurniawan, and W. A. Maya, "Students' attitude and motivation in mathematical physics," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 8, no. 3, p. 401, Sep. 2019, doi: <https://doi.org/10.11591/ijere.v8i3.20253>.
- [15] A. Ramdani, A. W. Jufri, G. Gunawan, M. Fahrurrozi, and M. Yustiqvar, "Analysis of students' critical thinking skills in terms of gender using science teaching materials based on the 5e learning cycle integrated with local wisdom," *Jurnal Pendidikan IPA Indonesia*, vol. 10, no. 2, pp. 187–199, Jun. 2021, doi: <https://doi.org/10.15294/jpii.v10i2.29956>.
- [16] G. Ladson-Billings, *CULTURALLY RELEVANT PEDAGOGY: asking a different problem*. S.L.: Teachers College Press, 2021.
- [17] T. Santoso, Y. M. Cholily, and M. Syaifuddin, "An analysis of students' errors in completing essay HOTS problems based on Watson's criteria viewed from the cognitive style perspective," *JTAM (Jurnal Teori dan Aplikasi Matematika)*, vol. 5, no. 1, p. 121, Apr. 2021, doi: <https://doi.org/10.31764/jtam.v5i1.3776>.

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