Article

ANALYSIS OF STUDENT'S FAULT BASED ON WATSON'S CRITERIA FOR SOLVING THE PROBLEM OF COMPOSITIONAL FUNCTION AND INVERS FUNCTION VIEWED FROM THE LEVEL STUDENT MATHEMATICS ABILITY IN THE CLASS OF XI TKJ-2 SMK SORE TULUNGAGUNG

Nur Anggraini Rizki[1], Maryono[2]
Tadris Matematika, Universitas Islam Negeri Sayyid Ali Rahmatullah Tulungagung,
Jl. Mayor Sujadi Timur Nomor 46 Tulungagung - Jawa Timur 66221
e-mail: nrizki8570@gmail.com[1], mario_stain@yahoo.com[2]

Abstract

The purposes of the research are for knowing the types of student's fault in the class of XI TKJ-2 who had high, moderate, and low of math competence for solving problems of compositional function and inverse function based on Waston's criteria, and for knowing the factors of cause student made fault along with for knowing the alternative solution to repair the student's fault. The research uses qualitative approach, with type of research is case study. The technique of data collection that was done by observation, written test, and interview. The results of the analysis are (1)The students who had high math competence did the kinds of fault which were skill hierarchy problem. (2) The students who had moderate math competence did the kinds of fault which were omitted data and omitted conclusion. (3) The students who had low math competence did the kinds of fault which were inappropriate data, omitted conclusion, and except the seven criteria above. (4) The factors of causes students make mistake are they are confused, not careful, do not use complete data and inaccurate data, do not understand the use of the compositional function formula, have not understood the concept of the invers function, takes a long time to understand the exercise, and do not re-check the answer (5) The alterative solution to repair the student's fault i.e., the students can improve their comprehension, accuracy of doing rechecking, make good use of time, and the students must be active to ask during the learning process. Whereas teacher can use learning method drill, method problem-based learning, and implement remedial teaching.

Keywords: *Analysis, Fault, Compositional Function and Inverse Function, Waston's Criteria*

Introduction

In mathematics there are mathematical abilities which are the basis and must be possessed by students. According to the National Council of Teachers Mathematics (NCTM), standards for mathematical abilities that must be possessed by students such as problem solving abilities, reasoning and proving, communication, connection, and representation. NCTM also states that, mathematical ability in problem solving is the first order of the central goal of mathematics education. Mathematical ability can be divided into 3 categories, namely high math ability,

moderate math ability, and low math ability. This ability is obtained from the average value of students in doing assignments while studying the mathematics material that has been given.

The Program for International Student Assessment (PISA) states that out of a total of 540,000 students, Indonesia is ranked 63 out of 70 countries for mathematics with a score of 386. Because there are so many students who think mathematics is a difficult subject to learn because they have to use formulas and don't know the application from the mathematics itself. Learning difficulty is a condition that creates obstacles in the student learning process. Where the obstacles cause these students to experience failure or at least are less successful in achieving learning goals. Students often have difficulty understanding math problems, both in the use of mathematical concepts, procedures, symbols, and notation. Learning difficulties can be reflected in student mistakes in working on math problems.

Student mistakes in working on math problems can be a benchmark to find out how far students have mastered the material. In learning mathematics, word problems have a close relationship in everyday life to train students in solving problems. Because in solving word problems, students must go through stages that require understanding and skills in understanding the questions, doing calculations, and skills in drawing conclusions. So, when students are faced with word problems, students must be able to solve them correctly.

Based on interviews conducted with mathematics teachers at SMK Sore Tulungagung, it was found that some students experienced difficulties in solving mathematical problems and problems in everyday life. Because students have not been able to analyze questions, use concepts, procedures and use symbols appropriately. The math teacher also stated that students of class XI TKJ-2 often made continuous types of mistakes in solving math problems and this could be observed from the results of the assignments.

Based on observations made of class XI TKJ-2 students at SMK Sore Tulungagung, it was found that almost all students in one class made mistakes in solving math problems. Starting from concept errors, procedural errors, and operating errors, which can be seen from the results of the assignments that have been given by the teacher.

One of the materials that must be learned by students is compositional functions and inverse functions. The material consists of function concepts, algebraic operations on functions, compositional function concepts and compositional function operations, as well as inverse function concepts and inverse function operations. So that students must understand in terms of concepts, procedures and skills in operating properly to avoid mistakes that students experience when solving problems related to material compositional functions and inverse functions.

In this study, to describe the types of student errors in solving mathematical problems, Watson's error criterion was used. Fault criteria according to Watson, are classified into eight types of errors, namely: Inappropriate Data/ID, Inappropriate Procedure/IP, Omitted Data/OD, Omitted Conclution/OC), Response Level Conflict/RLC, Undered Manipulation/UM, Skill Hierarchy Problem/SHP, and Above Other/AO. The purpose of this classification is to make it easier for teachers to know the types of student errors, to be able to find out the causes and find solutions to overcome student errors in solving existing problems.

As previous research stated that students with high mathematical abilities made incorrect data errors, missing data, and other category errors caused by students not being careful in reading the questions. Students with mathematical abilities are making incorrect data errors, missing data, missing conclusions, and problems with the skill hierarchy caused by students not being thorough and in a hurry in working on the questions. Whereas students with low mathematical abilities made incorrect data errors, inappropriate procedures, response level conflicts, missing conclusions, indirect manipulation, and other categorical errors caused by students not understanding the form of the questions and not understanding the concept of set material.

Based on the explanation above, the purpose of this study was to describe the types of errors of students with high, medium and low mathematical abilities based on Watson's criteria in solving compositional and inverse function problems. So that the cause of the error can be known and

alternative solutions can be found to correct student errors. By paying attention to these conditions, the researcher is interested in conducting qualitative research by giving the title: "Analysis Of Student's Fault Based On Watson's Criteria For Solving The Problem Of Compositional Function And Invers Function Viewed From The Level Student Mathematics Ability In The Class Of XI TKJ-2
SMK Sore Tulungagung".

RESEARCH METHODS

In this study researchers used a qualitative approach. Qualitative research is research that is carried out intensively, in which the researcher participates in the field for a long time, records carefully what happened, conducts a reflective analysis of various documents found in the field, and prepares a detailed research report. While the type of research used is a case study. Case study research is a type of research in which the researcher conducts in-depth exploration of programs, events, processes, activities, against one or more people. A case is bound by time and activity. So that researchers collect data in detail using various continuous data collection procedures.

Taking this type of research according to the purpose of the research is to describe student errors based on Watson's criteria, find out the causes of student errors, and find alternative solutions to correct student mistakes in solving compositional and inverse function questions in class XI TKJ-2 SMK Sore Tulungagung . The research subjects were 3 students in terms of the categories of high, moderate and low students' mathematical ability. Then the research subjects were given 2 items describing the compositional function and inverse function material. Data collection techniques are observation, written tests, and interviews. Where the data from the results of the written test were analyzed based on the error type indicators on the Watson error criteria.

According to Watson's fault criteria, it is classified into eight types of errors. First, Inappropriate Data/ID, namely students trying to operate at the right level, but choosing the wrong data. Second, Inappropriate Procedure/IP, namely students trying to operate at the right level, but using inappropriate procedures. Third, Omitted Data/OD where students lose one or more data. Fourth, Omitted Conclution/OC, namely students show reasons at the right level but fail to conclude. Fifth, Response Level Conflict/RLC, namely students show something at a certain level and then lower it to a lower operation for conclusions. Sixth, Undered Manipulation/UM, namely students respond correctly but the reasons or methods used are illogical or random. Seventh, Skill Hierarchy Problem/SHP, that is, students cannot solve problems because they do not have skills or lack of visibility. Eighth, Above Other/AO.

Based on the description of the types of fault according to Watson, the researcher presents Table 2.1 Indicators of Fault Criteria according to Watson as follows:

Table 2.1 Fault Criteria Indicator according to Watson

No.	Fault Criteria according to Watson	Indicator
1.	*Inappropriate Data/ID*	1. Students use wrong information. 2. Students enter incorrect data.
2.	*Inappropriate Procedur/IP*	1. Students use the wrong formula. 2. Students use steps that are not appropriate.
3.	*Omitted Data/OD*	1. Students use incomplete data.
4.	*Omitted Conclution/OC*	1. Students do not use the final results in solving problems to make conclusions. 2. Students write conclusions but the final results are not correct.
5.	*Response Level Conflict/RLC*	1. Students forgot to write down the unit in the final answer.

		2. Students solve the problem in two ways and the end result is different.
6.	*Undered Manipulation/UM*	1. Students use methods that are illogical or inappropriate. 2. Students find the final result correctly but are not accompanied by the correct steps for solving the problem.
7.	Masalah Hirarki Keterampilan (*Skill Hierarchy Problem/SHP*)	1. Students work on questions not until the final result. 2. Students make mistakes in calculations. 3. Students get the final result without being accompanied by a way of solving the problem.
8.	*Above Other/AO*	1. Students do not write down any answers. 2. Students rewrite the questions. 3. Students only write down known, asked, and answered.

The level of mathematical ability is divided into 3 categories, namely high mathematical ability, moderate mathematical ability, and low mathematical ability. In this study, the mathematical ability was obtained from the average score of students in doing the assignments given while studying the material on compositional functions and inverse functions. So that researchers can obtain categories of student abilities that will be used as the basis for selecting research subjects. To find the category of mathematical ability, the following formula is used:

$$\text{Mean (M)} = \frac{\sum X}{N}$$

$$\text{Deviasi Standar (DS)} = \frac{\sum (X - M)^2}{N}$$

Based on the description above, the researcher presents Table 2.2 which is an indicator of mathematical ability as follows:

Tabel 2.2 Mathematical Ability Indicator

Mathematics Ability Category	Indicator
High Mathematical Ability	Student scores > (M + DS)
Moderate Mathematical Ability	Student scores ≤ (M + DS)
Low Mathematical Ability	Student scores < (M + DS)

After the analysis of the results of the written test is carried out, it can be used as interview material to find in-depth information on why students make these mistakes. Then the analysis of the results of written tests and interviews that have been conducted by researchers is presented centrally so that they can answer the formulation of the problem in this study.

RESEARCH RESULTS AND DISCUSSION

Researchers made observations when the mathematics learning process took place in class XI TKJ-2. That the teacher focuses on demanding students play an active role when learning activities take place. When the teacher asks the assignments that have been given to students in the previous

meeting. It turned out that there were still many students who had not done the assignments given, and there was one student who stated that the questions given were too difficult to do. So the teacher asked one of the students who did the assignment to write down and present the results of their answers in front of the class. When the student wrote down the answer, it turned out that there were procedural and operational errors. In fact, the researcher also found that students in writing their answers used concepts that were not in accordance with the questions from the problem.

Based on the value of student learning outcomes, the following is a list of students' mathematical ability levels in the matter of compositional functions and inverse functions as follows:

Tabel 2.3 List of Mathematics Ability Levels of Class XI TKJ-2 Students
SMK Sore Tulungagung

No	Name	Student Scores (**X**)	Mathematics Ability Category
1	AALA	74.286	Moderate
2	AKPP	75.000	Moderate
3	AYP	86.429	High
4	AM	75.714	Moderate
5	AAM	76.429	Moderate
6	AAA	74.286	Moderate
7	AA	77.857	Moderate
8	ADAM	-	-
9	AYIZ	76.429	Moderate
10	AWDA	57.143	Low
11	ASFA	72.857	Moderate
12	AY	75.000	Moderate
13	ANAFS	73.571	Moderate
14	AEF	76.429	Moderate
15	ADP	69.286	Moderate
16	AJP	72.143	Moderate
17	ANEF	71.429	Moderate
18	A	68.571	Moderate
19	AGW	74.286	Moderate
20	AVA	71.429	Moderate
21	BANF	72.143	Moderate
22	BEN	71.429	Moderate
23	BOPK	77.143	Moderate
24	CSRS	70.714	Moderate
25	DFI	72.857	Moderate
26	DWW	75.000	Moderate
27	DAS	74.286	Moderate
28	DAK	57.857	Low
29	DAA	68.571	Moderate
30	DAC	70.000	Moderate

31	DDP	75.714	Moderate
32	DK	87.143	High
33	DES	72.857	Moderate
34	EDNF	74.286	Moderate
35	FAH	87.857	High
36	FNA	72.857	Moderate
37	FS	77.857	Moderate

Based on the table, the researcher chose 6 subjects who were included in the category of mathematical ability according to predetermined indicators. The research subjects consisted of 1 student with high math ability, 1 student with moderate math ability, and 1 student with low math ability. The following is a list of students who were selected as research subjects presented in the following table:

Tabel 2.4 List of Research Subjects

No	Name	Student Code	Mathematics Ability Category
1	DK	S1	High
2	AA	S2	Moderate
3	AWDA	S3	Low

Then the researcher used the code to make it easier to analyze the results of the research subject's written test. Where the written test result code consists of 7 digits (xx.xxx.xx). The first two digits are in the form of letters and numbers which indicate the code of the research subject, namely S1, S2, and S3. The next three digits are letters and numbers which represent the codes for question numbers 1 and 2, namely NS1 and NS2. In addition, the last two digits are numbers that indicate the steps of the research subjects in solving written test questions, namely 01, 02, 03, and so on. As for the example of coding from the results of the written test, namely (S1.NS1.01) read by the first research subject in solving question number 1 in the first step.

Meanwhile, the results of the interview also used a 6-digit code (xx.xx.xx). The first two digits are in the form of letters and numbers which indicate the code of the research subject, namely S1, S2, and S3. The next two digits indicate the order of interviews conducted with research subjects, namely W1, W2, W3, W4, W5, and so on. In addition, the last two digits represent the answers of the research subjects to the questions posed by the researchers, namely 01, 02, 03, 04, 05 and so on.. The coding example from the interview results, namely.. (S2.W2.01) was read by the second research subject in the second order of interviews for answers to the first question.

The questions that must be done by students to identify the types of mistakes made based on Watson's criteria:

1) An employee of a robusta company must implement two processes that must be achieved, namely yaitu $f(x) = 3 - 2x$ is a function of the processing of semi-finished robusta materials, and $g(x) = 3x + (a + 2)$ is a function of the process to produce Robusta ready to be consumed. If applicable $(f \circ g)(x) = (g \circ f)(x)$ in the process of producing robusta. Then calculate the value of a!

2) An electronics factory produces LED televisions, going through the first and second stages. In the second stage the factory uses machine B with the function $g(x) = 4x - 8$. If the first

and second stages produce the function $g \circ f(x) = 20x + 4$. Find the inverse function in the first stage of machine A!

The following is a description of the analysis of student errors in solving compositional and inverse function questions:

1. **Analisis Siswa Berkemampuan Matematika Tinggi dalam Menyelesaikan Soal Fungsi Komposisi dan Fungsi Invers**

    In question number 1 what is asked is the value of a from the process function to produce robusta which is ready to be consumed. The following are the results of the written test for question number 1 of the S1 subject.

Image 1. S1 Subject Written Test Results Number 1

Based on the results of the written test from the S1 subject in question number 1 above, it can be seen that the S1 subject used the right data (S1.SN1.01), wrote down what was asked in the problem (S2.SN1.02), wrote down the completion process (S1.SN1. 03), and find the final result of the value of a correctly (S1.SN1.04). This is supported by the results of the interviews, where it can be seen that the S1 subject is confident that the final result obtained for the value of $a = -4$ is a settlement, therefore it can be concluded that the S1 subject in solving question number 1 did not make a mistake and did not fulfill one indicator of the fault criteria according to Watson.

In question number 2 what is being asked is the inverse function in the first stage of machine A. Following are the results of the written test for question number 2 from subject S1.

Image 2. S1 Subject Written Test Results Number 2

Based on the results of the written test from the S1 subject on question number 2 to find $f^{-1}(x)$, it appears that the S1 subject used the right data in solving the problem (S2.SN2.01). The S1 subject also wrote down what was asked in the problem (S1.SN2.02) and carried out the

completion process with the appropriate steps in obtaining $f(x)$ (S1.SN2.03). But in the process of finding $f^{-1}(x)$ S1 subjects did not reach the final result (S1.SN.04). Based on the interview results, it can be seen that the S1 subject experienced problems when continuing the final step of $f^{-1}(x)$ because understanding the problem took a long time. Therefore it can be concluded that the S1 subject in solving question number 2 fulfilled one of the indicators of the fault criteria according to Watson, namely the Skill Hierarchy Problem/SHP.

This type of Skill Hierarchy Problem/SHP can be corrected by increasing accuracy and making good use of time in solving problems. So that students can write down ways and find solutions to problems with the right calculations and final results. Meanwhile, teachers can use the problem-based learning (PBL) method as an alternative solution in correcting students' mistakes in solving problems. The problem-based learning (PBL) method is a learning method that involves students in analyzing problems, estimating answers, searching for data, analyzing data, and concluding answers to problems. Therefore, if the teacher uses the problem-based learning (PBL) method, it can foster students' interest in learning, train students' thinking skills at a high level, and can guide students to find solutions to problems in the right way and calculation.

2. **Analysis of Students with Moderate Mathematics Ability in Solving Compositional Functions and Inverse Functions**

In question number 1 what is asked is the value of a from the process function to produce robusta which is ready to be consumed. The following are the results of the written test for question number 1 from subject S2.

Image 3. S2 Subject Written Test Results Number 1

Based on the results of the written test from subject S2 in question number 1 above, it can be seen that subject S2 wrote down the right data to solve the problem (S2.SN1.01). S2 subjects also wrote down what was asked in the problem (S2.SN1.02). Then subject S2 enters the correct data into the formula used (S2.SN1.03). However, for the next step, subject S2 uses incomplete data in writing the completion process (S2.SN1.04). Subject S2 also made the calculation correctly (S2.SN1.05), but the data used resulted in the final result in solving the problem being incorrect (S2.SN1.06).

Based on the interview results, subject S2 did not write down complete data, namely $(a + 2)$ from the $g(x)$ function. This is because the S2 subject in working on the questions was too hasty to submit a written test. Therefore it can be concluded that the S2 subject in solving question number 1 fulfilled one of the indicators of the fault criteria according to Watson, namely Omitted Data/OD and Omitted Conclution/OC.

This type of Omitted Data/OD can be corrected by increasing the accuracy in solving the problem. So that students can solve compositional function questions and inverse functions by using complete data according to what is known in the problem. Meanwhile, teachers can use the

drill learning method as an alternative solution in correcting student mistakes. According to Anitah, Manoy, and Susanah, there is a section on the steps for implementing the drill method, where the teacher pays attention to common mistakes that students often make to immediately make improvements. Therefore, if the teacher uses the drill learning method, it can guide students who have difficulty, correct student mistakes in solving math problems, and support students to achieve the expected learning goals.

While the type of Omitted Conclution/OC can be corrected by increasing accuracy and re-checking the answer. So that students can make a conclusion with the completion process and the final result that is right in solving the problem. Meanwhile, teachers can use the problem-based learning (PBL) method as an alternative solution in correcting students' mistakes in solving problems. The problem-based learning (PBL) method aims to stimulate higher-order thinking, acquire knowledge, and essential concepts from the subject matter. So, if the teacher uses the problem-based learning (PBL) method, it can correct student mistakes by supporting students to think critically and increasing students' accuracy in solving math problems.

In question number 2 what is being asked is the inverse function in the first stage of machine A. Following are the results of the written test for question number 2 from subject S2.

Image 4. S2 Subject Written Test Results Number 2

Based on the results of the written test from the S2 subject in question number 2, write down the appropriate data in the problem (S2.SN2.01). S2 subjects also wrote down what was asked in the problem (S2.SN2.02). In the initial step the S2 subject has written down the correct formula to find $f(x)$ first in solving the problem (S2.SN2.03). In fact, the formula used by subject S2 shows the calculation of the result of $f(x)$ correctly (S2.SN2.04). Subject S2 did not write down the solution in finding the final result $f^{-1}(x)$ but the final result that was written was the correct result (S2.SN2.05).

Based on the results of the interviews, it can be seen that subject S2 used a direct and logical solution to determine $f^{-1}(x)$ with the correct final result, so that it did not meet one of the indicators of the fault criteria according to Watson in solving problem number 2.

3. Analysis of Students with Low Mathematics Ability in Solving Compositional Functions and Inverse Functions

In question number 1 what is asked is the value of a from the process function to produce robusta which is ready to be consumed. The following are the results of the written test for question number 1 from subject S3.

Image 5. S3 Subject Written Test Results Number 1

Based on the results of the written test from the S3 subject in question number 1, he has written the right data to find the final result of the value of a (S3.NS1.01). The S3 subject also wrote down what was asked in the question (S3.SN1.02). Subject S3 also used the correct formula to solve the problem (S3.NS1.03). However, subject S3 entered incorrect $f(x)$ data into $g(x)$ (S3.NS1.04). In the process of obtaining an a value, the S3 subject performs proper calculations using the data he wrote down (S3.NS1.05). So that subject S3 wrote a conclusion from the value of a with the final result that was not right (S3.NS1.06).

Based on the results of the interviews, it can be seen that the S3 subjects in the process of solving the S3 subject questions did not enter the correct data because they did not double-check their answers. So that the S3 subject also in solving question number 1 fulfills one of the indicators of the error criteria according to Watson, namely Inappropriate Data/ID. This results in obtaining the value $a = \frac{3x-1}{3}$ with an incorrect final result due to entering incorrect data $f(x)$ into $g(x)$. Therefore, the S3 subject also fulfills one of the indicators of the fault criteria according to Watson, namely Omitted Conclution/OC.

This type of Inappropriate Data/ID can be corrected by increasing understanding of the concept of inverse functions. So that students can enter the right data in solving the problem. Meanwhile, teachers can use the drill learning method as an alternative solution in correcting student mistakes. According to Djamarah and Zain, the method of learning to drill or practice more is a way of teaching to instill and maintain students' habits in solving math problems so that students gain dexterity, accuracy, opportunities, and skills. So that if the teacher uses the drill learning method it can provide opportunities, train students to get used to solving math problems using the right data, and find appropriate and complete solutions.

Meanwhile, the type of Omitted Conclution/OC can be corrected by increasing accuracy, understanding related to the concept of the inverse function, double-checking the answers, and actively asking if you don't understand during the learning process. So that students can make a conclusion with the completion process and the final result that is right in solving the problem. Meanwhile, teachers can use the problem-based learning (PBL) method to stimulate higher-level thinking, gain knowledge, and essential concepts from the subject matter. Therefore teachers can use the problem-based learning (PBL) method to increase accuracy and correct student errors in solving math problems.

In question number 2 what is being asked is the inverse function in the first stage of machine A. Following are the results of the written test for question number 2 from subject S3.

Image 6. S3 Subject Written Test Results Number 2

Based on the results of the written test from the S3 subject in question number 2, he has written down what is known in the problem correctly (S3.NS2.01). Even subject S5 has also written down what is asked in the problem, namely to find $f^{-1}(x)$ (S3.NS2.02). However, subject S3 did not write down the completion process and final results in the problem.

Based on the results of the interviews, it can be seen that the S3 subject did not write down the completion process and the final results of the questions because they did not understand the concept of the inverse function properly. Therefore it can be concluded that the S3 subject in solving question number 2 fulfilled one of the indicators of the fault criteria according to Watson, namely Above Other/AO.

This type of Above Other/AO can be corrected by increasing student understanding regarding the concept of inverse functions and actively asking questions if they do not understand during the learning process. So that students can understand the problem, use concepts and procedures, and get the right solution in solving the problem. Meanwhile, teachers can carry out remedial teaching as an alternative solution in correcting student mistakes. According to Soleh, remedial teaching is a form of learning that is healing or correcting to improve student learning outcomes. So that if the teacher implements remedial teaching, it can help correct student mistakes in solving math problems and improve student learning outcomes.

CONCLUSION

Based on the results of the research and discussion that have been previously described, the conclusions obtained from this study are as follows: (1) Students who have high mathematical abilities in solving compositional function problems and inverse functions make 1 type of error based on Watson's criteria, namely the Skill Hierarchy Problem/SHP . (2) Students who have moderate mathematical abilities in solving compositional function problems and inverse functions make 2 types of errors based on Watson's criteria, namely Omitted Data/OD and Omitted Conclution/OC. (3) Students who have low mathematical ability in solving compositional function problems and inverse functions make 3 types of errors based on Watson's criteria, namely Inappropriate Data/ID, Omitted Conclution/OC, and Above Other/AO. (4) Factors causing students to make mistakes in solving compositional function questions and inverse functions include: students need a long time to understand the questions, are not thorough, do not double-check their answers, use incorrect data, and do not understand the use of compositional function formulas , do not understand the concept of inverse function. (5) There are alternative solutions to correct student errors in solving compositional function questions and inverse functions including: where students can improve understanding, accuracy, double-check their answers, make good use of time in solving problems, and students must actively ask if not understand during the learning process. Meanwhile, teachers in correcting students' mistakes can use the drill learning method or practice more, use the problem-based learning (PBL) method, and carry out remedial teaching.

SUGGESTION

In addition, researchers also provide several suggestions, schools should be able to consider it as input material to improve the quality of learning and learning outcomes in mathematics in order to improve school programs. For teachers, the teacher should be able to make a reference or input to find out the types of student errors so that they can further improve learning in the classroom, and determine appropriate learning steps to reduce student errors in solving math problems.

As for students, it is hoped that they will be able to find out the types of mistakes to increase their activeness and courage in expressing opinions, improve accuracy, skill, and be able to make good use of time in solving mathematical problems for further learning. So that students can improve their learning outcomes to be even better. As for other researchers, it is hoped that it will serve as a reference or reference to be developed with further research with more diverse subjects,

places, research materials, and to be able to examine more deeply the types of student errors in solving mathematical problems.

REFERENCES

Aisyah, Fitria Nur Kusti dkk. 2019. *Analisis Kesalahan Penyelesaian Soal Cerita Berdasarkan Kriteria Watson*, in the Journal Review of Mathematics Learning 4, no. 1 (2019): 12.

Destiani, Lusi Eri. 2020. *Kemampuan Siswa dalam Memecahkan Masalah Matematika Materi Trigonometri Setelah Melalui Proses Pembelajaran Daring pada Kelas XI SMA Negeri 2 Trenggalek*. Skripsi. Tulungagung: IAIN Tulungagung.

Fauza, Adrina dkk. 2020. *Perbedaan Peningkatan Kemampuan Pemecahan Masalah Matematis dan Motivasi Belajar Siswa Menggunakan Pembelajaran Penemuan Terbimbing dan Pembelajaran Ekspositori*, in the Journal of Mathematics Education 13, no. 2 (2020): 62.

Gunawan, Ansyori. 2016. *Analisis Kesalahan dalam Menyelesaikan Soal Cerita pada Mata Pelajaran Matematika Siswa Kelas V SDN 59 Kota Bengkulu*, in the Journal Elementary School Teacher Education Science 9, no. 2 (2016): 217.

Hakim, Thursan. 2005. *Belajar Secara Efektif*. Jakarta: Puspa Swara.

Hermawati, Herma dkk. 2018. *Proses Pelaksanaan Remedial Teaching terhadap Ketuntasan Belajar Matematika Peserta Didik*, in the Journal Soshumaniora 4, no. 2 (2018): 103.

Kusumawati, Elli dan Randi Ahmad Irwanto. 2016. *Penerapan Metode Pembelajaran Drill untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis Siswa Kelas VIII SMP*, in the Journal of Mathematics Education 4, no. 1 (2016): 51.

Mamik. 2015. *Metodologi Kualitatif*. Sidoarjo: Zifatama Publisher.

Maryati, Iyam. 2018. *Penerapan Model Pembelajaran Berbasis Masalah pada Materi Pola Bilangan di Kelas VII Sekolah Menengah Pertama*, in the Journal of Mathematics Education 7, no. 1 (2018): 64.

Mashuri, Sufri dkk. 2019. *Problem-Based Learning dalam Pembelajaran Matematika: Upaya untuk Meningkatkan Minat dan Prestasi Belajar Siswa*, in the Journal of Mathematics Education 14, no. 2 (2019): 122.

Muttaqin, Muhammad Nuzurul dkk. 2019. *Profil Kemampuan Matematika Siswa dalam Menyelesaikan Masalah Persamaan Garis Lurus berdasarkan Teori Apos*, in the Journal UIN Maliki Malang 5, no.1 (2019): 208.

Pramita, Monika Ajeng. 2020. *Analisis Kesalahan Siswa Dalam Menyelesaikan Soal Himpunan Berdasarkan Kriteria Watson di Kelas VII H MTsN 2 Trenggalek*. Skripsi. Tulungagung: IAIN Tulungagung.

Purwanto, Ngalim. 2018. *Prinsip-prinsip dan Teknik Evaluasi Pembelajaran*. Bandung: PT Remaja Rosdakarya.

Sarwoedi. 2019. *Analisis Kesalahan Siswa dalam Menyelesaikan Soal Matematika Berdasarkan Kriteria Watson*, in the Journal *Matematics Paedagogic* 4, no 1 (2019): 15.

Siregar, Nani Restati. 2017. *Persepsi Siswa Pada Pelajaran Matematika: Studi Pendahuluan pada Siswa yang Menyenangi Game*, in the Journal Universitas Islam Sultan Agung (2017): 224.

Sugiyono. 2019. *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta.

Yulianda, Putri dkk. 2019. *Deskripsi Kesalahan Siswa Berdasarkan Klasifikasi Watson Dalam Menyelesaikan Soal-soal Suhu dan Kalor*, in the Journal of Physics Education 8, no 11 (2019): 2.