The Analysis of Compliance Type Students Error In Resolving Integral Challenge of Trigonometry Function

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Abstract: *This study aimed to: 1) describe the types of errors made by compliance type students in solving trigonometric function integral questions, 2) describe the factors that cause compliance type students in making mistake to solve integral trigonometric function problems. The type of this research was descriptive qualitative. The subjects of this research are the second semester student of the Mathematics Education Study Program 2019/2020 academic year. The subjects were then given a DISC personality profile test and were selected 4 from 5 students with the Compliance personality type to do error analysis based on the Newman stage by focusing on indicators at the transformation stage, the processing ability and answer writing phase. Data analysis through data reduction, data presentation and drawing conclusions. Checking the validity of the data used source triangulation by comparing the results of the student's compliance type test with the results of the interview. The results showed that the type of error that occurred in the compliance type student in solving the integral trigonometric function is in a transformation error where the subject is unable to determine the correct formula in some of the questions given. All subjects process skills errors as a result of transformation errors made by previous students such as incorrectly determining the formula used to solve the problem, besides that, student errors occurred in determining changes in functions involving partial integrals and changes in the shape of a trigonometric function. All subjects made mistakes in writing the final answer for each mistake made, there were even students who were unable to complete the final answer correctly from the procedure used. The factors that cause student errors in solving integral trigonometric function questions include external factors and internal factors. Internal factors include physical condition, motivation, intelligence abilities, self-confidence and poor study habits of students. Meanwhile, external factors are the conditions of the learning environment that are not conducive.*

I. INTRODUCTION

Calculus is a branch of mathematics that has a fairly broad scope, including the concepts of limits, derivatives, integrals, and infinite series. Calculus is considered a very important branch of science not only in the field of science, but is also often widely applied in economics, engineering and so on. The Mathematics Education Study Program, FKIP Universitas Muhammadiyah Makassar makes calculus as a compulsory skill course with 3 credits. The main topics covered in calculus are differential (differential calculus) and integrals (integration calculus). The calculus course itself is divided into 3 parts, namely calculus 1 which discusses differentiation (derivative of functions), Calculus 2 discusses integrals (anti-derivatives) and further calculus discusses partial derivatives and integrals. In this course, students are expected to be able to understand the concept hierarchically. If from the beginning students studying calculus 1 do not understand the concept correctly, they will find it difficult to receive material in calculus 2.

In fact, students in the Mathematics Education Study Program turned out to make calculus a subject that was difficult for them to understand. It is evident from the results of the final exams for calculus 1 odd semester of the academic year 2019/2020 ago, out of 28 students in one class only 10 students scored> 70.The results of the answers done by students showed that there were many mistakes made in the differential calculation technique if involves the concept of trigonometry. The results of interviews with peer lecturers and several students who were constrained in solving trigonometric function questions revealed that in addition to having difficulty understanding the concepts used, they were also confused in determining what formula to use. Yet to be able to understand the integral material itself,

Related to the mistakes made by students in solving math problems, Gagne (Mutia, 2017) states that in learning mathematics there are two objects, namely direct objects and indirect objects. Direct objects consist of facts, concepts, skills

and principles. Facts include terms or names, notations or symbols / symbols and so on. While the concept is abstract so that it is possible to group an object. Skills relate to the student's ability to provide answers. Therefore, after studying, students are expected to be able to gain an understanding of the four items so that they do not have difficulty working on the questions.

Errors are also discovered by (Jan, 2012)who stated "a major source of difficulty experienced by children in the problem solving process is transforming the written word into mathematical operations and symbolization of these". This is in line with (Limardani et al., 2015) which states that if a person has a hard time he will make mistakes. This confirms that difficulty is one of the causes of an error in doing test questions.

Through error analysis, as stated by (Maria & Legutko, 2008) that an undisclosed error that is anchored in the student's mind, therefore becomes a major threat to the formation of student knowledge so that it will be beneficial for students and teachers if the error can be expressed and proven. The mistakes made by students need to be given a solution. To find out the solution, it is necessary to analyze the types of errors made by students in solving math problems and the factors causing them. Previous research conducted by(Widodo, 2013)identifying student errors in solving problems can be divided into 3 stages. The first stage is habitual errors, misinterpretation and factual errors, the second stage is misconceptions and principles and the third stage is mistakes in principles and procedures. It turns out that the dominant types of errors are misconceptions and procedures.(Jha, 2012)explains five errors according to Newman, including reading errors, comprehension errors, transformation errors, processing skills errors and coding errors. From the results of his research on 100 fourth grade students in Assam, India, it was shown that the students' errors occurred more in problem comprehension skills and transformation skills.

In order to improve students' learning abilities, teachers are also expected to be able to know the characteristics of each student because one of the factors that influence learning is psychological factors, especially personality. Martson (1893-197) classified personality types into a category known as DISC (Dominant-Influence-Steady-Compliance). Compliance is one of the personality types contained in the DISC system which can be interpreted as the type that follows the rules. According to(Edysen Shin, 2013)Compliance types are extraordinary in terms of details and procedures. In addition, students with a Compliance personality have better accuracy than other personality types. other than that(Edysen Shin, 2013)stated that even though he has a personality that tends to obey the rules, in learning mathematics, even high Compliance personality types can make mistakes in solving math problems. Likewise in the calculus course for integral material of trigonometric functions which requires a good understanding of concepts, proficiency in procedures and deepening of principles to solve problems. Therefore, this study aims to analyze the errors of the compliance type students in solving trigonometric function questions based on the Newman stage.

II. RESEARCH METHODS

This type of research was a descriptive study with a qualitative approach. This research is intended to reveal, analyze, and provide an overview of the types of errors made by students in solving the integral material questions on trigonometric functions and the factors that cause errors in students who have Compliance personality. This research was conducted at the Universitas Muhammadiyah Makassar in academic year 2019/2020 Mathematics Education Study Program. As for the data collection procedure, the researcher conducted a subject selection test by giving a DISC personality test to students so that students with the Compliance type were obtained. After that, the researcher gave a test sheet about the material for the integral trigonometric function, total 5 validated questions and then analyzed the types of errors. After that, 3 people who had got Compliance personality type was selected to conduct in-depth interviews regarding the mistakes they have made by considering the smoothness of oral communication. The data analysis technique in this study started from the reduction stage by focusing on student answers that referred to Newman's types of errors. Furthermore, thap presentation of data by clarifying and identifying data about student answers based on Newman's error indicators was then presented. Lastly was drawing conclusions.

III. RESULTS AND DISCUSSION

a. Results of Research Instrument Validation
    In this study, the DISC personality instrument has been valid and reliable because it has undergone a number of tests. The observation and interview sheet instruments have been validated by the validator
b. Personality Test Results

An online personality test was conducted on 29 June 2019 and was attended by 25 students. After implementing the DISC test, an examination was carried out and obtained 4 Dominance students, 3 influence students, 7 steady students, 5 compliance students and 6 students are in mix of 2 personality types

Table 3.1 Percentage of student personality results

Personality	Frequency	Percentage
Dominance	4	16%
Influence	3	12%
Steady	7	28%
Compliance	5	20%
A combination of 2 types	6	24%
Total	25	100%

From the results of the DISC personality test, out of 5 students who have the compliance personality type, the researcher determined 4 students as research subjects with the consideration that the four people showed errors in solving the questions while 1 other person answered the whole question correctly.

c. Test Results of the Questionnaire on Integral Trigonometric Functions and interview guides

The math sheet test on June 30, 2019, which consists of 5 items can be used as data to analyze the types of errors made by compliance type students in solving math problems.

The test results are described based on the type of error in each subject. Of the 5 students, there are Compliance types 4. The subject still made transformation errors, skill process errors and answers writing errors. For reading and understanding stage errors, compliance type students did not make mistakes because the questions given were not story questions, so researchers focused more on mistakes at the transformation stage, the process skills stage, answer writing and carelessness. The interview was conducted after the subject did a math problem test

d. Description of research results

a) TC Subject 1

Following are the answers to TC1's work

Figure 1 TC1 test results question no.5

Based on the results of the TC1 test In question number 5 the TC1 subject seems to have made a mistake at the transformation stage. The TC1 subject cannot determine the exact formula used to solve the integral problem above. Subject TC 1 uses steps to solve the integral rational function to solve the problem which should use the integral substitution method to solve it. Basically TC 1 is able to use the steps to solve the integral rational function, but TC is unable to determine the correct formula for the problem above. So what happens is TC 1 fails to find the final answer. Based on the results of the interview, it was found that the TC1 subject focused on the denominator of the question so that it equated the questions to solve the integral rational function for repetitive linear factors.

b) TC2 Subject

Following are the answers to TC2's work

Figure 2 TC test results for question number 3

The error made by the TC2 subject occurred in question number 3, namely making a transformation error. Like the mistakes made by the previous subject, the TC2 subject failed to determine the correct formula used to solve the problem model as above. TC2 is more likely to use partial integration techniques to solve it even though the problem can be solved using the integral substitution method by simply assuming u = x2. Overall the TC2 subject understands what is being asked is also able to assume correctly even though in the process of calculating, the original function of cos x2 is also wrong because it uses the partial integral solution of the trigonometric function with even powers. TC 2 subjects were affected by almost the same but different examples when solving problems with other partial integration techniques. TC subjects can perform according to the partial function integral procedure but fail to find the correct final answer due to using the wrong formula. This is consistent with the results of the interview, it is known that TC 2 equates to the case example given earlier, which can be solved by partial integration techniques. $\int x \cos x \, dx$

c) TC Subject 3

The following is the answer to TC 3's work

Figure 3 TC test results, question number 3

In the picture above, it can be seen that TC 3 also experienced a transformation error in problem number 3 by solving the problem with a partial integration technique which should have been solved using the substitution method. Unlike the case with TC 2 subjects who also made mistakes at the process skills stage of the same problem, where TC 2 determined the original function cos x2 with partial integration, while TC 3 ignored the variable x2 so that only cos x was left. Because from the beginning TC 3 did not write the explanation so that it confused TC itself. As a result, the final answer is also wrong because the example is not correct. TC3 also careless in not checking the answers before they are collected.

d) TC Subject 4

Picture of TC test results 4 question number 5

Mistakes committed by TC4 starts from the transformation error that is in changing the value from 1 / cos2x to sec x which should be sec2x. Furthermore, TC 4 made mistakes at the process skills stage, namely in using the procedures or steps used to solve the problem. TC4 uses the derivative multiplication theorem to solve for the integral. This results in the finishing procedure used incorrectly resulting inTC4 could not find the final answer from solving the questions. This happened because of the carelessness of the TC4 Subject from the start. Based on the results of the interview, it was found that TC4 basically knows the form of the change from 1 / cos2x to sec2x, but because of carelessness and haste he wants to complete the answer so TC4 is wrong to execute the question. .

Based on the test results, of the 5 subjects, there were no errors in reading the questions. They can understand the meaning of the symbols or terms used in the problem. This is in line with the research conducted(Mulyadi et al., 2014) which says that very small reading errors occur in solving math problems is proven only 4, 65% who make reading errors. Compliance type is a personality type that is detailed and careful so that they can make reading errors that tend to be very small.

Based on the test results, the 5 subjects did not experience errors in understanding the questions because the questions given for the integral did not need to write down what was known and asked (Jha, 2012) states that the misunderstanding is caused by the student not being able to understand the meaning of the whole question, writing down what is known and being asked about the question.

Based on the test results, there is a TC 4out of 5 subjects still made transformation errors. The subject is unable to determine the exact formula used to solve the problem.(Junaedi et al., 2015)argued that transformation errors occur when students fail or cannot determine the formula used to determine the completion procedure used. In line with that(Zakaria et al., 2010) revealed that transformation errors are among the mistakes most often made by students.

Based on the test results, it can be seen that all the subjects made processing skills errors as a result of transformation errors made by previous students such as incorrectly determining the formula used to solve these problems, besides that in determining changes in functions that involve partial integrals and changes in the form of a trigonometric function, students still do error. This is in line with research(Sari et al., 2018) who argues that process skills errors occur if they do not carry out the completion process correctly including incorrectly entering data, wrong doing calculations, and not continuing the process so as to get a conclusion.

Based on the results of the study, it can be seen that all the subjects made mistakes in writing the final answer for every mistake made by students, and there were even students who were unable to complete the final answer of the procedure used correctly. This is in line with(Junaedi et al., 2015)which states that writing errors occur when students cannot answer in accordance with

the questions asked. In addition, the polya states that it is necessary to carefully check the correctness of the results or solutions obtained.

5. Factors that cause student errors in Compliance Type in Solving Trigonometric Function Integral Problems

Based on the results of the interview, it was concluded that several factors caused student errors in solving integral trigonometric function questions including external factors and internal factors. Internal factors include physical condition, motivation, intelligence abilities, self-confidence and poor study habits of students. While the external factor is the condition of the learning environment that is not conducive, especially when some of the material is done online which causes compliance type students to feel dissatisfied and need face-to-face learning for calculus courses. In addition, the facts show that especially for the material for integral trigonometric functions the cause of student errors is their confusion in determining the formula if the questions given are almost the same and mastery of trigonometric concepts is still lacking.

IV. CONCLUSION

1. Based on Newman's type of error in solving integral trigonometric function problems, it was found that all research subjects did not make mistakes in reading and understanding but made transformation errors by being unable to determine the right formula to solve the problem. In addition, all research subjects made mistakes in processing skills and errors in writing the final answer as a result of the transformation errors made. Based on the results of the analysis, it shows that the most mistakes made by compliance type students in solving trigonometric integral questions are transformation errors, processing skills errors and errors in writing the final answer.
2. Factors that cause student errors in solving integral problems of trigonometric functions include external factors and internal factors. Internal factors include physical condition, motivation, intelligence abilities, self-confidence and poor study habits of students. Meanwhile, external factors are the conditions of the learning environment that are not conducive

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