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Analysis of Error in Working of Questions on the Semester Final Exam of Mathematics Statistics for Students of UIN Saizu Purwokerto

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ABSTRACT

Learning evaluation of the certain subject is important to be done in university. It is to be able to see, improve and increase the quality of learning outcomes. One form of evaluation for a Mathematics Statistics course is the final semester exam, abbreviated as UAS. Purpose of this article to determine the error type of students in working the final semester exam, percentage of students who do mistakes and amount of error on each type, as well the most mistakes . Research used a quantitative descriptive method imposed on all of population as many as 98 respondents. Data collection used documentation and the data analysis that is statistics descriptive. Research results showed that as many as 14 type of error with one among them is findings a new of error type. Percentage of students do error on each type is the concept error 96.94%, principle 92.86%, fact 20.41%, conclusion no used correct reasoning 8.16% , error because procedure or algoritm 4.08%, *skill error* 21.43%, error without pattern 37.76%, technical 3.06%, and error in mark 5.1%, and successive types of error that is data error , operation , write the exact same long answer to two different questions, language interpretation, as well *finishing error* each of which is 1.02%. The same as in according of the type errors are found percentage of the number of errors that is 40.12%, 28, 09%, 6.17%, 2.47% , 1.23%, 6.48%, 11.42%, 0.93%, 1.54%, and the others is 0.31% respectively. Most mistakes is the concept error.

A. INTRODUCTION

One of learning objective of mathematics that is students have ability to encounter a condition change of the world which is always growing. It through the act exercise based on the think ways of logical, rational, critical, careful, honest , effective , and efficient (Suherman, 2003). The purpose have been achieved or not yet can be known from the students learning outcomes through exam of competency at a certain material or a study material in an evaluation process of math learning. On mathematics learning in high college, learning evaluation of certain course need to be done for view , improve, and increase the learning outcomes quality. Based on the learning evaluation can be known if students experienced a mathematics study difficulty so that it make easy to analyze and give that's problem solution with the hope experience the change of learning results (Layn, 2017). Go along with it, a theory stated that one of task of mathematics education is it make a clarify of the students think process at time to learn mathematics and interpret the information of mathematics knowledge collected through observation to the students behavior when build concepts or finished the problem which the students think process will be constructed (Widodo, 2013). Based on the description above then finished the mathematics problem become the important thing in mathematics education because study mathematics without the application of concepts or principle will lost meaning . Wilson in NCTM (*National Council of Teachers* Mathematics) stated that the problem solving or finishing have the special interest in mathematics learning. The main goal of mathematics learning is developed ability of mathematics problem solving or finishing varied and complex (Wilson, 1993). The NCTM Statement reinforces its importance to solve or finish the mathematics problem through do examination questions of mathematics in the learning activity process so that (Adhim, 2019) can be known as far as the students concept understanding to material have been learned. Through do the examination questions of mathematics also can be known the student difficulties to the material are given.

Students are learners in high college. Every student who studies mathematics in high college certainly cannot be denied that they have difficulty with different levels. Students answered wrong in certain material exam questions in the implementation of learning evaluations can be used to find out the students difficulties.

One of the examination form called as UAS that is a form of exam conducted at the end of learning in high college. By using the learning evaluation with giving math problem then can diagnose or find out strengths and weakness of students. Reys et al stated that one of the evaluation goal to diagnose strengths and weakness of individual (Reys, 1998). Weakness of individual on mathematics learning can diagnosed from the experienced difficulties when students worked or finished questions with are shown by the students do errors in gave the answer . Definition of error according to the Indonesian Dictionary is wrong or mistake or oversight or do something no intentionally (Tim, 2008). Whereas there is a theory which stated that error is deviation from something that have is known the truth (Zain, 2017). There are many kinds of error type in worked or finished the mathematics questions, among others Soedjadi groups the student errors in they finished the mathematics questions is error of fact , error of concept , error of principles , and error of operation (Syahril, 2021), (Adhim, 2019), (Rengkung, 2022), and (Raufany, 2019). Other studies have found error type of procedure or algorithm , no exists meaning in the concept understanding, and no exists of the concept continuity (Wahyuni, 2018). Error of procedure is one of the found type in research (Sofianingsih, 2018). Based on the research results also found a number of error happened to the students in finished questios of mathematics that are nonhierarchy of step , inability to manipulate steps of the problem solving, error of concept , error of technical , error of algorithm , error of principle , error of data , error of the language interpret, error of the logic using for the conclusion interesting, error of the definition or theorem using, no checked the solution again, error of calculations , answers randomly , and answer in a manner directly (Zakiyah, 2020). Error of the language interpret including in category of the misconception type of the interpretation error in language , as in research (Aini, 2020). The error classification in finished questions of mathematics is also stated (Saputri, 2017) includes *reading errors* (errors of understanding), *planning errors* (errors of planning), *skill errors* (errors of skills), and *finishing errors* (errors of the final results). Error in worked the other mathematics question stated in research (Yuliani, 2018) namely error of translation , error of technical , error of data , error of concept , error without pattern , error of sign , and no checked of solution again.

Mathematics Statistics is a course material in the level of the undergraduate study program at high college is considered the difficult material by students . it can is known from mistakes of students when do questions of UAS of Mathematics Statistics implicated at the low learning results. The material of Mathematics statistics are important because they were basic concept of statistics so that is looked at necessary to research in this problem.

Based on the exposure, the goal to be achieved in this article are 1). to determine error of types made by students of fifth Semester 5 (Five) of academic year 2022/2023 at the Mathematics Tadris Study Program of Faculty Tarbiyah and Teacher Training (FTIK) UIN Saizu Purwokerto in do questions of Mathematics Statistics UAS, 2). to know percentage of students who do error in do questions of Mathematics Statistics UAS on each item of error type , 3). to know percentage of many error made students in do the Mathematics Statistics UAS on each item of question , and 4). to know the most error which it is be done by students in working of Mathematics Statistics UAS. To achieve the objective that its analysis used descriptive statistics through classification of error , counting of percentage and value of maximum . The article is organized systematically in introduction , methods , results and discussion , and also conclusion.

B. RESEARCH METHODS

This research used the quantitative method because the data of this research are numbers and the analysis used statistics (Sugiyono, 2009). Conducted to this study objective then the statistics analysis used the descriptive statistics which it analyzed classification of error type, determine to the percentage of every error type, and value of maximum used to know the most error found. Descriptive statistics is used to analyze the data with the way describe the collected data as exists without mean to make a general conclusion or generalization (Sugiyono, 2009). This quantitative research is supported by analysis of descriptive statistics so this means that it was not to generalize such that all of the population are used as respondent of research. This population is all of fifth semester students in academic year 2022/2023 of Mathematics Tadris Study Program, Faculty Tarbiyah and Teacher Training (FTIK), State Islamic University (UIN) Prof. K.H. Saifuddin Zuhri Purwokerto called as UIN Saizu Purwokerto who are taking a course of Mathematics Statistics. Students taking a course of Mathematics Statistics as many as 98 people clustered in three classes namely 5TMA-A, 5TMA-B, and 5TMA-C entirely made as the research respondent. Data is collected by using documentation that is the documents of UAS results of Mathematics Statistics as much 98 students. Question of the Mathematics Statistics UAS Statistics consists of three type are form test of essay used to describe the research variable. The errors of working of Mathematics Statistics UAS were the variable in this research so As for variables in study This is error in do about UAS Statistics Math , so analysis is done at the student steps in give

the answers. The three question that is used in this research are (1). A random variable X has probability density function (*pdf*) $f(x) = x^2$ if $0 < x \leq 1$, $f(x) = \frac{2}{3}$ if $1 < x \leq 2$, dan $f(x) = 0$ if $x \leq 0$ or $x > 2$. Find the median of X!. (2). Exponential distribution has *pdf* $f(x) = \frac{1}{\theta} e^{-\frac{x}{\theta}}, x < 0, \theta > 0$ writted by $X \sim EXP(\theta)$. Let $X_1, X_2, \ldots, X_{10}$ be a random sample of size $n = 10$ from an exponential distribution with mean 2, $X_i \sim EXP(2)$. Find the *MGF* of the sum $Y = \sum_{i=1}^{10} X_i$!. (3). Consider a random sample of size n from the uniform distributed population, $X_i \sim UNIF(-\theta, \theta)$. Find *E(X)* and estimator $\hat{\theta}$! If at the analysis find error then noted as type of error which of all the errors exist. The next step calculate the students percentage who do error on each of error type and the percentage of the number of errors in each question, also the most error is done. Percentage of students who do error on each of error type counted with formulas:

$$P_M = \frac{M_S}{M} x\ 100\ \% \quad (1)$$

Information:
P_M = Percentage of Error
M_S = A lot students who do error on any type item error .
M = The amount whole student
Whereas to calculate the percentage of many errors made students on each error of type are:

$$P_S = \frac{S_I}{S_T} x\ 100\ \% \quad (2)$$

Information:
P_S = The percentage of the number of errors in each type of error
S_I = The number of errors in each type error
S_T = The total number of possible errors from every type error

C. RESULT AND DISCUSSION

1. Types of Errors in Working on the Mathematics Statistics UAS Questions

The students mistake answer the UAS test or question of the Mathematics Statistics course so that no reach the expected exactly answer referred an error in this research. The error can be seen in the question or problem working process when students found the true answer and also is known the error type who he did . The research result showed that the error types made by students as presenting in Table 1 as follow.

Table 1. The Error Types of Research Result

No	The Error Type
1	Error of Concept
2	Error of Principle
3	Error of Fact
4	Conclusion No Used the Correct Reasoning
5	Error of Procedure or Steps
6	Error of Skill (*Skill Error*)
7	Error without Pattern
8	Error of Technical
9	Error of Data
10	Error of Sign
11	Error of Operation
12	Write the same Answer for Two different questions
13	Error of the Language Interpretation
14	Error of the Final Result (*Finishing Error*)

Types of error presented in Table 1 are found based on the analysis to the results of students do the Mathematics Statistics UAS. Decision making to determine type of error is obtained from matched the mistakes which are made students with the existing theories and also earlier studies through each its indicators. The research result found as many as 13 types of error as presented in Table 1. Types of the error are in numbers 1 to 11, numbers 13, and 14. Meanwhile type of error made students as in number 12, there is no in theory or research previously which that is used in this research. Error of concept happen because error to determine the formula , no write the formula , no give the answer , error of using definition , and no formulate

something concept of mathematics with the correct symbol as the indicators put forward in Rahmawati Yuliyani and research by Anna Lucia Rengkung , Anekke Pesik, and Cori Pitoy . Error of principle is found by existing of error in the question translate and errorsby no notice precondition in using of formula written by Alfin Nurlaili Zain. Error of fact is happened by error of writing of the conventions stated in mathematics symbols and error of interpreting the obtained results as Gema Raufany and Titi Solfitri said it . Whereas error of cause inference no used the correct reasoning discovered by Zakiyah Anwar and Hidayani in his research. Still by the same researcher that errors were also found in procedural , technical , data, and the language interpretation. The procedural errors are indicated with disability manipulate steps of the question answer. Error of technical is caused no do question until finished. A data error occurred by students replace the conditions with other information that is not in accordance, for example y already is known but still considered with another y. Error of the language interpretation is showed with error give the meaning of the mathematics statement, for example happens to reveal the unbiased estimator is stated with the estimator can not.

Error of skill (*skill error*) in this study is showed with error no understand the algebra operation concept, example $E(\bar{x}) = \frac{1}{n}\{E(x_1) + E(x_2) + \cdots + E(x_n)\}$. As for errors without pattern is found by student do question in a manner haphazardly, example is requested to determine E(X) and the estimator parameter but rather prove the pdf function. Whereas error of sign is found in wrong to write the mathematics formula of MGF . Error of the final results (*finishing error*) i.e. discovered because students not enough capable to take the final result conclusion of $M_Y(t)$ and less ability represent the final results in problem context, as whole this error disclosed in Rahmawati Yuliyani . In this research, error of students also is seen to accordance indicators by Alfin Nurlaili Zain et al that error of operation happened due to an error of the steps doing no hierarchical to finish it, i.e. students writed their answer in the final result directly and wrong of step of the moment method.

In accordance this study objective to know type of errors were possible done by students in working of the Mathematics Statistics UAS so this research result can find type of the novelty error done student that is write the same answer exactly for two different questions. This type of error most likely happened deriberately because the answer is description long and written the same exactly like case a *copy paste* .

2. Description Statistics of Percentage of the Error Type

The descriptive Statistics presented the results and answered four objective of this article as in the introduction. In Table 2 can be seen the analysis results to many students who do the error in working of the Mathematics Statistics UAS. Percentage of the concept error shows 96.94 %, the principle error 92.86%, the fact error 20.41%, conclusion no used correct reasoning 8.16% , the procedure or step error 4.08%, meanwhile *skill error* shows 21.43 %, error without pattern 37.76 %, the technical error 3.06%, and the sign error obtained 5.1%, as well as the data error , operation , write the same answer exactly for two different questions , interpretation of language , as well error of the final results (*finishing error*) of each is 1.02% . The concept error discovered by the formula error , no do question ,no formulate a mathematics concept with the correct symbol.

The research results that in every type of error also is found student do the error more than once in the Mathematics Statistics UAS. It is shown in Table 2 that type of the concept error that is amount students who do it as many as 95 students but amount error made 130. Percentage of many concept error carried out by students 40.12%, amount of the principle error 28, 09 %, there is 6.17% error of fact, conclusion no used correct reasoning obtained 2.47 %, error of procedure or step equal 1.23 %, *skill error* is 6, 48%, error without pattern is 11, 42 %, error of technical obtained 0.93 %, error of sign 1.54 %, and respectively the data error , operation , write the same answer exactly for two different questions , interpretation of language and the final results (*finishing error*) each of all is 0, 31 %.

The following Table 2 describes amount of students who do error of each type of error. Table 2 also amount of the error made students in each type of error is used as a guideline to calculate the percentage.

Table 2. Total Students and Types of Errors

The Error Type	Amount of Students	Amount of Error Type
Error of Concept	95	130
Error of Principle	91	91

Error of Fact	20	20
Conclusion No Used the Correct Reasoning	8	8
Error of Procedure or Steps	4	4
Error of Skill (*Skill Error*)	21	21
Error without Pattern	37	37
Error of Technical	3	3
Error of Data	1	1
Error of Sign	5	5
Error of Operation	1	1
Write the Same Answer for Two Different Questions	1	1
Error of the Language Interpretation	1	1
Error of the Final Result (*Finishing Error*)	1	1

All of the error types as listed in Table 2 existed in theory or discovered by studies. In this research find one of the novel error type is done students in working of the Mathematics Statistics UAS, namely write the same answer exactly for two different questions. Logically, that matter is suspected as form of intentional answer considering the answer is long description and written the same exactly.

D. CONCLUSION AND SUGGESTIONS

1. Conclusions

Based on the analysis results and discussion can be taken many conclusions.

1. There are 14 types of errors where one of them is a new error type that has not existed in previous theory and research.
2. The percentage of the number of students who make mistakes in each type of error in a row is 96.94 %, 92.86%, 20.41%, 8.16% , 4.08%, 21.43 %, 37.76 %, 3.06%, 5.1%, 1.02%, 1.02%, 1.02%, 1.02% , and 1.02% ..
3. The percentage of the number of errors made by students in each type of error, respectively 40.12%, 28.09 %, 6.17%, 2.47 %, 1.23 %, 6,48%, 11,42 %, 0.93 %, 1.54 %, 0,31 %, 0,31 % , 0,31 %, 0,31 %, and 0,31 %.
4. Students make the most mitakes on concepts.

2. Suggestions

This research results can be used as a basic for lecturer to learn in a course of the Mathematics Statistics especially and in mathematics generally. Lecturers are expected to emphasize understanding concepts in learning of Mathematics Statistics and give attention to other difficulties through mistakes made by students in an exam.

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