ANALYSIS OF COLLEGE STUDENTS' DIFFICULTIES IN MATHEMATICS EDUCATION OF THE CLASS 2013 IN SEMBILANBELAS NOVEMBER UNIVERSITY IN SOLVING THE PROBLEM OF ONE-WAY ANALYSIS OF VARIANCES *(ONE WAY ANOVA)* ON APPLIED STATISTICS COURSE

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Abstract

Statistic is one of the branches of applied mathematical science developed by Karl Pearson (1857-1936). Applied statistic is the study of the application of statistical use. Many students think that applied statistic course are difficult, which can only mastered by smart students. Even the students' anxiety arises every time they are dealing with the applied statistic course. This anxiety due to the acquisition of applied statistic value is generally lower compared to the acquisition of the other course's value, it is seen that many students who have not been able to solve the problem related to the analysis of one-way varience (One-Way Anova). This research is done to identify, recognize, analyze, then got a result of research about students' difficulties in solving the problem of one-way variance analysis. Specifically the purpose of this study is to determine the difficulties that experienced by the students of mathematics education of sembilanbelas November University, Kolaka, in solving the problem of analysis of one-way variance inapplied statistic course, as well as the efforts that can be done to overcome these difficulties. To realize it in this research, the researcher use verifikatif qualitative design to describe the actual situation and verify it, this research tries to describe the actual requirement for the learners of mathematics which of course through the requirement analysis process then verified in order to find an ideal learning design. This research will be conducted in scientific procedures in the academic realm. This research will be carried out at Sembilanbelas November University, kolaka, with active students of Teachers and Education Faculty on mathematics, alumni, and lecturer of Teacher and Education Faculty on mathematics study program will be chosen as informant with purposive sampling technique. In-depth interview, unstructured observation, and dokumen analysis will be pplied as the technique of data collection in this research, while the instruments to be used in the data collection are semi-structured interview guides, observation sheets, and documents. In analyzing the data, the researcher uses content-analysis that systematically and objectively identifies a specific message characteristic. From the results obtained, that there are three types of mistakes made by the students, such as, there are ten students who make a conceptual mistake that is equal to 29,41%, twenty two students or equal to 64,71% who make a mistake in principle, while those who make verbal errors as much as nineteen students or equal to 55,88%.

Kata Kunci: The results of apllied statistical studies, analysis difficulty, one way anova, teacher and education faculty of mathematics.

A. Introduction

Statistics play an important role in research, both in modeling, formulation of hypotheses, in the development of tools and instruments of data collection, preparation of research design, to determine the samples, and also in the data analysis. In many cases, the processing and data analysis does not separate from the application of certain statistical techniques and methods, whose presence can provide a basis for explaining the relationship. Statistics can be used as a tool to determine whether the causality relationship between two or more variables is correctly correlated in an empirical causality or the relationship is only a random or accidental. Statistics have provided some simple techniques in classifying data and in presenting data more easily, so that, the data can be understood more easily. Statistics have been able to present a measure that can either populate the population or declare the variation and provide a better picture of the central tendency of the variable.

Mastery of concepts in statistics, especially in the field of university level is depent on the mastery of the mathematical statistics I and mathematical statistics II concept that owned by students in the previous semester. Generally, the concepts of applied statistics is no different from the concept of mathematical statistics I and mathematical statistics II, but the concepts of applied statistics that are in the upper semester more expanded and deepened to suit the curriculum development and tailored to the students' ability. Therefore, so that students can easily master the aapplied statistical material, then, the basic material that is in the subject of mathematical statistics I and mathematical statistics II must be fully mastered. But on the contrary, if the mastery of mathematical statistics I and mathematical statistics II is neglected, then the students will experience many difficulties on the mastery of applied statistics materials will even affects the score of mathematical teaching research and also impact on the weak analysis that will be used in research thesis. The fundamental mistakes experienced by a student while studying at university will be difficult to fixed and affect hiss intellectual development in the future because it is no longer faced with the learning situation but has ben very faced with the process of applying science in society and in the world of work. Therefore, if there is a mistake on the concept in students, then the concept will be brought on and surely it is difficult to changed

Such circumstances are also experienced by the mathematic education students of SembilanBelas November University, Kolaka. This is known through the pre-observation that made at the university by conducting an interview to the lecturer of the applied statistics subject on the mathematics study program of Sembilanbelas November University, Kolaka. From this pre-observation obtained information that there are still many students who have difficulty in solving problems related to parametric statistic, so the score of most students are still very low. One of the problems is the difficulty in solving the questions related to the One-Way analysis of variance. Based on the description above, the writer intends to conduct a research about the *Analysis of College Students' Difficulties in Mathematics Education of the Class 2013 in Sembilanbelas November University on Solving the Problem of One-Way Analysis of Variance (One Way Anova) in Applied Statistics Courses*. With hope, after the research is done, it can be determined some appropriate steps to overcome these difficulties.

B. Literature Review

Understanding of Learning

Based on Hudojo (1988:1) said that learning is a process done by individuals to obtain behavior changes that apply in a relatively long term and accompanied by the individual who from not able to do something to be able to do it. Activities and efforts to achieve behavioral change is a learning process, whereas, behavioral change itself is the result of learning.

Student Difficulties in Studying Applied Statistic

Generaly, difficulti can be interpreted as a condition in the learning process that recognized by the presence of certain barriers or problems to understand the characteristics of mathematics. Without the characteristics understanding of math, surely, the students will find out a lot of difficulties in order to solving the questions related to One-Way Analysis of Variance (One-way Anova). In the process of learning, one is not always as fluent as what is expected, as well as the process of math learning, students often experience or find out some difficulties or obstacles in order to achieve the learning objectives.

Refers to some point of view on learning is often found that the difficulties of learning both internally and externally can be studied from the dimension of lecturers and students dimension, while studied from its stages, learning difficulties can accur at the Pre-learning, the main learning process, and post-learning (kadir, 2015:15).

From the student dimension, learning difficulties that may arise before the learning activities can be related to the students characteristic, wheter regard to interests, skills, and experiences. During the learning process, difficulties are often related to attitudes toward learning, motivation, concentration, messages learning processing, re-digging the message beneath. (Kadir, 2015:16).

While from the lecturers dimension, the learning difficulties can occur before the learning activities, during the learning process, and evaluation of the learning outcomes. Before the learning process, learning difficulties are often related with othe learning organize. In the other hand, during the learning processs, learning difficulties are often concerned with teaching materials and learning resources. Whereas aafter the learning process, the learning difficulties that faced by lecturers mostly related to the evaluation of learning outcomes (Suherman, 2013:85).

Cooney (in Galu, 2001:9) said that the students difficulty in learning the applied statistic can be classified into three types, such as: (1) the problems in learning the concept, (2) the problem to applied the principle, and (3) the difficulty in solving the verbal issue

The Students' Difficulties In Understanding the Concept
Example:A researcher wants to know about the influence of teaching method to the math learning achievement. The teaching methods are devided into four, such as: Speech Method (A_1), Discussion (A_2), Task Method (A_3), and Mix Method (A_4).
➢ Research Hypothesis:
➢ H0: There is no significant difference in mathematics learning achievement between the students who follow the Speech Method Learning, Discussion Method, Task-Giving Mehod, and Mix Method Learning.
H1: There is a significant difference in mathematics learning achievement between the students who follow the Speech Method Learning, Discussion Method, Task-Giving Method, and Mix Method.
➢ Statistical hypothesis:
H0: $\mu_1 = \mu_2 = \mu_3 = \mu_4$
$H_1 : \mu_1 > \mu_2 > \mu_3 > \mu_4$

If the students answer as the explaination above, it means that the student makes a conceptual mistake, because the student does not know that the hypothesis testing in one way analysis of variance use the Fisher Statistical Test, where this test aims to find out whether the four methods aare have influence or not, so the suitable statistical hypothesis to use is the Two Tailed Statistical Hypothesis Test, whereas the form of this statistic is :
H0: $\mu_1 = \mu_2 = \mu_3 = \mu_4$
$H_1 : \mu_1 \neq \mu_2 \neq \mu_3 \neq \mu_4$

The Students' Difficulties In Applying the Principle
The student who does not understand about the principle will facing some difficultiess in order to applying the principle. This iss recognized by the presence of: (1).The students' inability to determine the suitable formula which is used to solving the problems in statistic, (2). The student knows the formula of one way analysis of variance, but the students cannot apply it to solve the problems in mathematics. Example of students' difficulties in understanding and applying the principle:

Table 3.2. The Students' Mathematic Data Outcomes of SMAN 1 Kolaka in XI IPA

(A_1)	(A_2)	(A_3)	(A_4)	Total
3	5	5	8	
2	6	8	9	
4	5	7	10	
0	7	7	9	
4	4	7	8	

$n_1 = 5$	$n_2 = 5$	$n_3 = 5$	$n_4 = 5$	$N = 20$
$\sum X_1 = 13$	$\sum X_2 = 27$	$\sum X_3 = 34$	$\sum X_4 = 44$	$\sum X_{tot} = 118$
$\sum X_1^2 = 45$	$\sum X_2^2 = 151$	$\sum X_3^2 = 236$	$\sum X_4^2 = 390$	$\sum X_{tot}^2 = 822$
$\overline{X}_1 = 2,6$	$\overline{X}_2 = 5,4$	$\overline{X}_3 = 6,8$	$\overline{X}_4 = 8,8$	$\overline{X}_{tot} = 5,9$

Put into this following formula:
Calculation:

$$JK_{antarA} = \sum \frac{\left(\sum X_A\right)^2}{n_A} - \frac{\left(\sum X_{tot}\right)^2}{N}$$

$$= \frac{\left(\sum X_{A1}\right)^2}{n_{A1}} + \frac{\left(\sum X_{A2}\right)^2}{n_{A2}} + \frac{\left(\sum X_{A3}\right)^2}{n_{A3}} + \frac{\left(\sum X_{A4}\right)^2}{n_{A4}} - \frac{\left(\sum X_{tot}\right)^2}{N}$$

$$= \frac{13^2}{5} + \frac{27^2}{5} + \frac{34^2}{5} + \frac{44^2}{5} - \frac{118^2}{20} = 101,8$$

$$JK_{tot} = \sum X_{tot}^2 - \frac{\left(\sum X_{tot}\right)^2}{N} = 822 - \frac{118^2}{20} = 125,8$$

$JK_{dal} = JK_{tot} - JK_{antar} = 125,8 - 101,8 = 24$

$$\sum X_{tot}^2 - \sum \frac{(X_A)^2}{n_A} = 822 - \left(\frac{13^2}{5} + \frac{27^2}{5} + \frac{34^2}{5} + \frac{44^2}{5}\right) = 24$$

Atau JK dal:

$db_A = a-1 = 4-1 = 3$

$RJK_{antar} = JK_{antar} : db_{antar} = 101,8 : 3 = 33,93$.
db dalam = N – a = 20-4 = 16
$RJK_{dal} = JK_{dal} : db_{dal} = 24:16 = 1,5$
$F_{hitung} = RJK_{antar} : RJK_{dal} = 33,93 : 1,5 = 22,66 \rightarrow$ Look up to table F

Tabel 3.3. Summary Table of Variance Analysis to Test the Hypothesis of Four Groups

Variation sources	JK	Db	RJK	F_h	F_{tab}		Decision
					5 %	1%	
antar A	101,8	3	33,93	22,62	3,24	5,29	Signifikan
Dalam	24	16	1,5	--	--	--	--
Total	125,8	19	--	--	--	--	--

If the students answer as above, it means that the students categorized make a principle understanding mistake. Because of:

1. The first step to solve the steps in one way analysis of variance should be finding the total quadratic value and then finding the sum quadratic value between variants.
2. Most of students cannot distinguish the definition of a value and n value
3. Most of students cannot find the F table value, even though the formula to determine the F table is already understood. This is seen from the outcomes of mid-semester in applied statistic course for the 6th semester on academic year 2014/2015 that conducted by the applied statistic lecturer.

Students Difficulties In Solving the Verbal Problem
If the cost F significant, followed by simple effect test between cell using the t-Scheffe formula as follow.

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\frac{2 * RJK_{dal}}{n}}}$$

For n1 = n2 : , where the db t = db intern

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{RJK_{dal}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

For n1 ≠ n2: , where the db t = db intern

t-Scheffe test: db t equals to db intern = 16

t1-2 : $t = \dfrac{2,6 - 4,0}{\sqrt{\dfrac{2x1,5}{5}}} = -3,615$ → significant

t1-3: $t = \dfrac{2,6 - 6,8}{\sqrt{\dfrac{2x1,5}{5}}} = 5,422$ → significant

t1-4: $t = \dfrac{2,6 - 8,8}{\sqrt{\dfrac{2x1,5}{5}}} = -8,004$ → significant

t2-3: $t = \dfrac{4 - 6,8}{\sqrt{\dfrac{2x1,5}{5}}} = -1,807$ → non significant

t2-4: $t = \dfrac{4 - 8,8}{\sqrt{\dfrac{2x1,5}{5}}} = -4,389$ → significant

t3-4: $t = \dfrac{6,8 - 8,8}{\sqrt{\dfrac{2x1,5}{5}}} = -2,582$ → signiicant

If the student replied as above, then categorized student to make mistake in verbal problem because student:
1. Analysis after anova or post Anova (post hoc) is done if the null hypothesis (Ho) is rejected means the value of F arithmetic> F table, but most students still can not do post hoc test because this is related to type II error No.3.
2. Most students do not know how to position multiple comparisons statistics well. Kadir (2015: 65)

Factors That Influence the Students' Difficulties In Learning
The incidence of students difficulties and mistakes in order to leaarning the applied statistic course is influenced by several faactors, ssuch as: (1). Pssychological factors, basicaly, factors that caused by the students' physical condition. (2). Intellectual factors are factor that caused because of the material that taught by the teachers is exceed the potential level of students' ability. (3). Pendagogical factors are are a factor that caused by the lack of qualified teacher in choosing the materials and methods. (4). Facilities and infrastructure are factors caused by inadequate facilities and infrastructure.

a) Statistic Definition
Statistic have been used to states some facts, generally in numbers that ordered into a table or diagram, that describe a problem. A statistic that describes about something usually named indenticaly with the matter of concerned. For example, population statistic, birth statistic, educational statistic, agricultural statistic, production statistic, health staatistic, and much more. Statistic is a knowledge that relate to the way of fact collection, the processsssing and also how to analyze it, drawing conclusion as well as the reasonable decision maker bassed on the fact and analysis.

b) The Definition of Applied Statistic
Applied statistic is: An analysis tool in Numerical Description form to describe every obtained data from the population and sample, and then to be approximate, forcasting, decision making, and others (Qodratullah, 2014:5).
In the process, applied statistic is emphasis on how to process the data using SPSS, STATA, and other data processing software, in applied statistic which is usually done by a researcher or a businessman is using the SPSS. Statical Product and Service Solutions (SPSS) itself is a statistic computer program that capable to quickly and precisely process the statistic data become various output as desired.

Next, to know the statistic element itself, in its application known by two approaches, such as: Descriptive Statistic and Inferential Statistic.

1. Descriptive Statistic is a statistic that is used to describe or to analyze a research result, but it is not designed to make an extend conclusion (generalitation/inferention), a research that does not use a sample, the analysis will use a descriptive statistic. As well as a research that using a sample which is the researcher won't make a conclusion about where is the sample came from, then the statistic that should be used is Descriptive Statistic.

2. Inferential Statistic is a statistic that is used to analyze the data sample and the result will be generalized for the population which is the sample came from. There are two kinds of Inferential Statistic, namely Parametric Statistic and Non-Paaremetric. Parametric statistic mainly used to analyze the data interval or ratio, which is taken from the population with normal distribution. In the other side, Non-Parametric mainly used to analyze the nominal and ordinal data from the free-distributed population.

In a research, the data can devided into: qualitative data and quantitative data. Qualitative data is data in sentence form, words or pictures. Meanwhile, quantitative data is a data in numerical form or numerized qualitative data (scoring). Quantitavie data can devided into two main point, namely, discrete data and continuum data. Discrete data is a data that obtained from the counting result or numbering (not measuring). This kind of data is also called nominal data. Nominal data is usually obtained from the explorative or survey research. Continuum data is a data that obtained from the result of measurement. Continuum data can be devided into three, such as: Ordinal (tiered or ranking data), Interval (a data that have the same distance, but do not have absolute zero value (absolute)) and Ratio (a data that have the same distance and have a absolute zero value).

c) Analisis Varian (ANOVA)

Anova (*Analysis of variances*) is used to do a multivariable comparability analyze. The technique of comparative analysis is using "t" test which is finding the significant difference of two **mean** and effective if only it has two variable. To overcome this issue, there is a better comparative analysis technique namely Analysis of Variances, shortly ANOVA. Anova is used to compares the average of population, not the population variety. The type of data that is suitable for Anova is the nominal and ordinal on the free variable, if data in the free variable is in interval or ratio form, it must be changed into ordinal and nominal. While the bound variable is the interval or ratio data. Gunawan (2013: 32)

Here are the basic asssumsion that must be fulfilled in analysis of variances:

1. Normality

The data distribution must be normal, so that the normal distributed data can be reached by increasing the number of sample in groups.

2. Similarity of variance

Each group should come from the same population as the same variance. If the number of samples is the same in each group, then the similarity of the variance can be ignored. But if the number of sample in each group are not the same, then the similarity of population variance is necesssary

3. Free observation

The samples should be taken randomly, so that every observation is a free information.

Anova is more aaccurate to a number of same samples in each group, for example, each group variable, the number of sample is 250 people

Anova can be classified into several criteria, such as:

1. One way classification (One Way ANOVA)
    One way classification Anova is ANOVA that based on one criteria observation or one factor that caused a variances.

2. Two way classification (Two Way ANOVA)
    Twwo way claasssification is ANOVA that based on two criteria observations or two factors that caused a variance.

3. Many ways calssification (MANOVA)
    Many ways classification is ANOVA that based on many criteria observation.

d) One Way Analysis of Variances (*One Way Anova*).

1. Definition of One Way Analysis of Variances*(One Way Anova)*

One way anova is used if only the analyze matter is consists of one dependent variable and one independent variable. The interaction of a sharedness between factors in influencing the independent variable, by itself has been eliminated. If there is an interaction means the effect of one factor on the dependent variable has a line that is not parallel to the effect of other factors on the dependent parallel variable, then there is no interaction between the factors.

2.   One Way Analysis of Variances Steps *(One Way Anova)*
Gunawan (2013: 34) states the steps in hypothesis testing in one way analysis of variances ssuch as:
(1) Calculating the sum of total quadrate (JK_{tot}):

$$JK_{tot} = \sum X_{tot}^2 - \frac{\left(\sum X_{tot}\right)^2}{N}$$

(2) Calculate the sum of quadrate amongst groups (JK_{antar}):

$$JK_{antar} = \sum \frac{\left(\sum X_A\right)^2}{n_A} - \frac{\left(\sum X_{tot}\right)^2}{N}$$

(3) Calculate the sum of quadrate in groups (JK_{dal}):

$$JK_{dal} = JK_{tot} - JK_{antar}$$

(4) Calculate the Mean (the average number of quadrate) amongst groups

(RJK_{antar}): $RJK_{antar} = \dfrac{JK_{antar}}{a-1}$ → a = jumlah kelompok

(5) Calculate the average number of quadrate in group (RJK_{dal})

$RJK_{dal} = \dfrac{JK_{dal}}{N-a}$ → N = number of all samples

(6) Calculate cost F_{hitung} with following formula: $\dfrac{RJK_{antar}}{RJK_{dalam}}$

(7) consult on table F with db numerator (a-1) and db denominator (N-a)
(8) Decision rule : if Fcount is bigger than F table at the certain significant level(Example: ts 5% or 1%), then Ha is accepted and H0 is denied.
(9) Make decision, whether there is significant difference or not
(10) Make a summary table of variances analysis for hypothesis testing on K sample

Tabel 3.1. Summary Table of Variances Analysis for Hypothesis Testing On K Sample

Variation source	JK (SS)	db (df)	RJK (MS)	F_h	F_{tab}	Taraf sig 0.05	0.01
antar A	$\sum \dfrac{\left(\sum X_A\right)^2}{n_A} - \dfrac{\left(\sum X_{tot}\right)^2}{N}$	a-1	$\dfrac{JK}{a-1}$	$\dfrac{RJK_{antar}}{RJK_{dal}}$	....		
Dalam (error)	$JK_{dal} = JK_{tot} - JK_{antar}$	N-a	$\dfrac{JK_{dal}}{N-a}$	--	--		
Total	$\sum X_{tot}^2 - \dfrac{\left(\sum X_{tot}\right)^2}{N}$	N-1	--	--	--		

3.   *Multiple Comparisons Statistic*(Posthoc test)
Post anova analysis (*post hoc*) is done if the zero hypothesis (Ho) is denied. The function of post anova analysis is to find out which group is different. This is indicated by F count that shows a difference. If the F count shows no difference, of course the post anova analysis is unnecessary to do. There are some analysis techniques that can be used to do a post anova analysis, namely, Tuke's HSD, Bonferroni, Sidak, Scheffe, Duncan, and others.
If cost F significant, followed by simple effect test between cell with this following t-Scheffe formula.

For n1 = n2 : $t = \dfrac{\overline{X_1} - \overline{X_2}}{\sqrt{\dfrac{2 * RJK_{dal}}{n}}}$, where the db t = db intern

For n1 ≠ n2: $t = \dfrac{\overline{X_1} - \overline{X_2}}{\sqrt{RJK_{dal}\left(\dfrac{1}{n_1} + \dfrac{1}{n_2}\right)}}$, where the db t = db intern.

C. Methodology

Time and Place of Research

This research will conducted for 10 months, from January 2017 until October 2017 at Kolaka, Southeast Sulawesi, in University of SembilanBelas November Kolaka on Teacher and Education Faculty in class B cademic year 2015/2016 at the 6th semester that consist of 45 students.

Type of Research

This research uses a qualitative approach with qualitative verifikatif design. This design comes from a paradigm of qualitative approach which is a purely qualitative research design, although the theory is still loose. Thus, this design is more of a pure qualitatively than a qualitative descriptive design. A qualitative verifikatif research design is a concept that seeks to find out what is the meaning behind a phenomenon and then verify it to prove the cause of the phenomenon itself. Related to this research plan, the verifikatif design is intended to describe the real fact at the field and then verified to prove the cause of real fact of the data that happens in the field.

Data and Data Source

The data in this research are primary and secondary data. Primary data, that is the data of learning result in applied statistic course which obtained by mathematics student especially specified in class 2013, conducted by the researcher. In addition, secondary data are data documentation and data support that can be obtained through references or literature.

Technique of Data Collection

Technique of data collection is the most strategic step in the research, because the main goal on every research is to get the data as the result (Sugiyono, 2009:224). To collect the data in this research is done by these following stages:

1. Observation

Observation is done with the aim that researcher can observe directly the teaching and learning process of applied statistic course in class B of mathematics students on the 7th semester class of 2013, SembilanBelas November University Kolaka. Where in the learning process the material taught is the material which is related to the One-Way Analysis of Variance *(One Way Anova)*.

2. Test

The test is done to obtain data about the basic difficulties that experienced by students in solving the One-Way Analysis of Variance (One-Way ANOVA) question in parametric statistics, as well as to determine some students who can be used by the researcher as the research subject. The problem is identified by the mistakes that students did in answering the question about One-Way Analysis of Variance (ANOVA) given by the researcher.

3. Interview

Interview is conducted to students and lecturer. The interview with students is conducted in order to find out more about the difficulties that experienced by students in solving the question of One-Way Analysis of Variance *(One Way Anova)*. While, interview to the lecturer is conducted to determine what factors that causing the students have difficulties in solving the question about One-Way Analysis of Variance (One-Way Anova) and what efforts that made by the lecturer in order to overcome these difficulties.

Instrument of Data Collection

In this research, the main instrument or the main research tool is the researcher itself. As well as qualitative research characteristics, that the researcher becomes the key instrument in the process of collecting data research (Sugiyono, 2009:222). Besides that, in this research also used a complementary instrument, that is applied statistic test in question form relating to One-Way Analysis of Variance material in parametric statistics, it aims to explore more earlier about the difficulties that experienced by the students in finishing the question matter of variance analysis in parametric statistic.

Technique of Data Analysis

The data analysis that used in this research is descriptive analysis; it means that all of research results are described. The data analysis in this research is preceded by data reduction, then the

data presentation and the last it drawing a conclusion based on the result of data analysis. The above three processes can be seen from the following description:

a. Data reduction, activities that refer to the process of transforming a written raw data in the data field, selecting data, and simplifying the data and divided the data into group.

b. Data presentation, is a complete data along its analysis which is includes analysis of observation result and analysis of the result of direct interview that is considered in the conclusion.

c. The conclusion of data analysis, it is about the difficulties, some factors that make the students have some difficulties and what is the teacher should do to overcome the students' difficulties in solving the question about One-Way Analysis of Variance (*one way anova).*

D. Finding and Discussion
1. Finding

In this section will be presssented the data analysis that includesss: analysis of observation results, analysis of test results assessment, analysis of students' interview result, and the analysis of lecturer's interview result.

Analysis of Observation Result

Observation iss done during the subject matter about One-ay Analyssiss of Variance in the applied statistics course that taught by lecturer in the classroom in order to see directly the process of applied statistics learning, which is became the target of research. It is intended to know the activities of students in the teaching andlearning process until it ends. In addition, through the observation it can be seen some steps and methods used by lecturer in presenting a matter of One-Way nalyssis of Variance in the subject of applied statistic.

In the observation process, the researcher found that the lecturer doess not convey the goal that must be achieved in the learning process, aas we know that by conveying the goals at the beginning of the learning process will make the students understand about what things that they have to focus on. Giving motivation during teaching aand learning is aalso very important to do by lecturer, because the students who have high motivation in learning the One-way Analyssis of Variaance can struggle to learn the material. In this observaation it is seen that the lecturer does not attempt to gives some motivations to the students about the importance of studying the One-Way Analysis of Variance (One-Way Anova) in applied statistics course, so that there are many of passive students in the teaching and learning process. Besides of that, some of students cannot focus and give their attention to the material that being taught. It seems that almost none of students are responding the question that asked by lecturer. In aaddition, the student are also does not ready to work on the question that given by the lecturer and they only wait for the answer and explaination from the lecturer.

The distribution of problem example in the learning process is very important to do, because it will helps the students to more deeply understand about concept, principle, and operation which is used in solving one way analysis of variances (one way anova) problem. In this research found that the lecturer is not careful in giving the problem example.

Based on the researcher observation, it can be concluded that most of students do not have an applied statistic handbook, they just count on the note takes during the lecturer explain the material. So, in order to learn at home, the student does not have a reference or others. In case of closing the lectures, it indicates that the lecturer doess not summarize the material that hav been taught, even though based on the researcher opinion, summarizing the lectures material is very important, so that the students can really understand the material.

Analysis of Test Results

The analyzed test is the test from task that wrongly done by many students. There is only one item that consist of several steps contained in the assessment test. Here is the analysis of the result of assessment test for item that wrongly done by the most of students.

Item

A researcher wants to find out the influence of learning method to the mathematics learning achievement. The learning method clessified into four, which is: Inquiry Learning Method (A_1),

Discovery Learning Method (A_2), Problem Based Learning Method (A_3), and Group Investigation Learning Method (A_4).

Students answer 01

➤ Research hypothesis :

H0: There is no difference on mathematics learning achievement between the student who follow the Inquiry Learning Method (A_1), Discovery Learning Method (A_2), Problem Based Learning Method (A_3), and Group Investigation Learning Method (A_4).

H1: There is a difference on mathematics learning achievement between the student who follow the Inquiry Learning Method (A_1), Discovery Learning Method (A_2), Problem Based Learning Method (A_3), and Group Investigation Learning Method (A_4).

➤ Statistical hypothesis:

H0: $\mu_1 = \mu_2 = \mu_3 = \mu_4$

$H_1 : \mu_1 > \mu_2 > \mu_3 > \mu_4$

Tabel 4.1. Data of Students Mathematics Learning Outcomes of SMAN 1 Kolaka on XI IPA

(A_1)	(A_2)	(A_3)	(A_4)	Total
45	55	70	65	235
52	40	51	30	173
60	65	60	55	240
75	35	80	46	236
55	75	55	70	255
77	43	50	35	205
80	90	70	65	305
40	35	65	32	172
65	48	72	40	225
45	50	52	35	182
66	38	65	53	222
71	75	72	63	281
42	60	53	69	224
40	85	72	66	263
72	47	60	57	236
80	90	54	51	275
53	55	55	52	215
40	42	57	35	174
57	72	56	60	245
60	35	69	45	209
80	56	71	30	237
61	42	73	38	214
52	67	57	70	246
43	85	80	33	241
55	30	55	35	175
n_1 = 25	**n_2 = 25**	**n_3 = 25**	**n_4 = 25**	**N = 100**
$\sum X_1$ = 1466	**$\sum X_2$ = 1415**	**$\sum X_3$ = 1574**	**$\sum X_4$ = 1230**	**$\sum X_{tot}$ = 5685**
$\sum X_1^2$ = 90460	**$\sum X_2^2$ = 88593**	**$\sum X_3^2$ = 101172**	**$\sum X_4^2$ = 65322**	**$\sum X_{tot}^2$ = 345547**
$\overline{X}_1$ = 58,64	**$\overline{X}_2$ = 56,6**	**$\overline{X}_3$ = 62,96**	**$\overline{X}_4$ = 49,2**	**$\overline{X}_{tot}$ = 56,85**

Put into the following formula

Calculation:

$$JK_{tot} = \sum X_{tot}^2 - \frac{\left(\sum X_{tot}\right)^2}{N} = 345547 - \frac{(5685)^2}{100} = 22354{,}75$$

$$JK_{antarA} = \frac{\sum \frac{\left(\sum X_A\right)^2}{n_A} - \frac{\left(\sum X_{tot}\right)^2}{N}}$$

$$= \frac{\left(\sum X_{A1}\right)^2}{n_{A1}} + \frac{\left(\sum X_{A2}\right)^2}{n_{A2}} + \frac{\left(\sum X_{A3}\right)^2}{n_{A3}} + \frac{\left(\sum X_{A4}\right)^2}{n_{A4}} - \frac{\left(\sum X_{tot}\right)^2}{N}$$

$$= \frac{1466^2}{25} + \frac{1415^2}{25} + \frac{1574^2}{25} + \frac{1230^2}{25} - \frac{5685^2}{100} = 2478,03$$

$JK_{dal} = JK_{tot} - JK_{antar} = 22354,75 - 2478,03 = 19876,72$ Atau

$$\sum X^2_{tot} - \sum \frac{\left(X_A\right)^2}{n_A} = 345547 - \left(\frac{1466^2}{25} + \frac{1415^2}{25} + \frac{1574^2}{25} + \frac{1230^2}{25}\right) = 24$$

JKdal:

$$\sum X^2_{tot} - \sum \frac{\left(X_A\right)^2}{n_A} = 345547 - 325670,28 = 259580,76$$

$db_A = a-1 = 4-1 = 3$

$RJK_{antar} = JK_{antar} : db_{antar} = 2478,03 : 3 = 826,01$
db dalam = N – a = 100-4 = 96
$RJK_{dal} = JK_{dal} : db_{dal} = 19876,72 : 96 = 207,05$
$F_{hitung} = RJK_{antar} : RJK_{dal} = 826,01 : 207,05 = 3,99$ → look up to F table

Tabel 4.2. Summary Table of Variances Analysis to Testing the Hypothesis of 4 groups

Variation sources	JK	db	RJK	F_h	F_{tab} 5 %	1%	decision
antar A	2478,03	3	826,01	3,99	2,70	2,14	*Significant*
Dalam	24	96	207,05	--	--	--	--
Total	22354,75	99	--	--	--	--	--

Testing Decision:
Based on the test result on table 3.3, the obtained value of F_{hitung} = 3,99 > F_{tabel} = 2,70 at the significant level < ⌐ = 0,05, then H_0 is denied and H_1 is accepted. With the rejection of H_0 it can be concluded that "there is an impact of mathematics learning outcomes between the student that taught through Inquiry Learning Method (A_1), Discovery Learning Method (A_2), Problem Based Learning Method (A_3), aand Group Investigation Learning Method (A_4) on the class XI IPA of SMA Negeri 1 Kolaka"
If cost F significant, followed by simple effect test between cell using the t-shceffe formula as follow.

for n1 = n2 : $t = \dfrac{\overline{X_1} - \overline{X_2}}{\sqrt{\dfrac{2 * RJK_{dal}}{n}}}$, where the db t = db intern

for n1 ≠ n2: $t = \dfrac{\overline{X_1} - \overline{X_2}}{\sqrt{RJK_{dal}\left(\dfrac{1}{n_1} + \dfrac{1}{n_2}\right)}}$, where is db t = db intern

T-scheffe test: db t is equal to db intern = 96

a. $t = \dfrac{\overline{X_1} - \overline{X_2}}{\sqrt{\dfrac{2 * RJK_{dal}}{n}}}$ = t1-2 : $t = \dfrac{58,64 - 56,6}{\sqrt{\dfrac{2 x 207,05}{25}}} = 2,51$ → significant

b. $t = \dfrac{\overline{X_1} - \overline{X_3}}{\sqrt{\dfrac{2 * RJK_{dal}}{n}}}$ t1-3: $t = \dfrac{58,64 - 62,96}{\sqrt{\dfrac{2 x 207,05}{25}}} = -5,31$ → non significant

c. $t = \dfrac{\overline{X}_1 - \overline{X}_4}{\sqrt{\dfrac{2 * RJK_{dal}}{n}}}$ t1-4: $t = \dfrac{58,64 - 49,2}{\sqrt{\dfrac{2x207,05}{25}}} = 11,59 \rightarrow$ significant

d. $t = \dfrac{\overline{X}_2 - \overline{X}_3}{\sqrt{\dfrac{2 * RJK_{dal}}{n}}}$ t2-3: $t = \dfrac{56,6 - 62,96}{\sqrt{\dfrac{2x207,05}{25}}} = $ -7,81 $\rightarrow$ non significant

e. $t = \dfrac{\overline{X}_2 - \overline{X}_4}{\sqrt{\dfrac{2 * RJK_{dal}}{n}}}$ t2-4: $t = \dfrac{56,6 - 49,2}{\sqrt{\dfrac{2x207,05}{25}}} = 9,09 \rightarrow$ significant

f. $t = \dfrac{\overline{X}_3 - \overline{X}_4}{\sqrt{\dfrac{2 * RJK_{dal}}{n}}}$ t3-4: $t = \dfrac{62,96 - 49,2}{\sqrt{\dfrac{2x207,05}{25}}} = 16,90 \rightarrow$ significant

The Test Decision:
a. Based on scheffe t test result, the obtained value of t_{hitung} in the amount of 2,51 > t_{tabel} is 1,66 at the significance level < $r = 0,05$, then H_0 is denied and H_1 is accepted. With the denied of H_0 then it can be concluded that "the average of students' learning outcomes that taught through Inquiry Learning Method (A1) is better than the average of students' outcomes that taught through Discovery Learning Method (A2)"

b. Based on the schaffe t test result, the obtained value of t_{hitung} in the amount of -5,31 < t_{tabel} is 1,66 at the significance level < $r = 0,05$, then H_0 is accepted and H_1 is denied. With the acception of H_0 then it can be concluded that "the average of students' math learning outcomes that taught through Inquiry Learning Method (A1) is not better than the average outcomes of students that taught through Problem Based Learning (A3)"

c. Based on the t test result, the obtained value of t_{hitung} in the amount of 11,59 > t_{tabel} is 1,66 at the significance level < $r = 0,05$, then H_0 iss denied and H_1 is accepted. With the denied of H_0 then it can be concluded that "the average of students' learning outcomes that taught through Inquiry Learning Method (A1) is better than the average of students' outcomes that taught through Group Investigation Learning Method (A4)"

d. Based on the t test result, the obtained value of t_{hitung} in the amout of -7,81 < t_{tabel} is 1,66 at the significance level < $r = 0,05$, then H_0 is accepted and H_1 is denied. With the acception of H_0 it can be concluded that "the average of the students' math learning outcomes that taught through Discovery Learning Method(A_2) iss not better than the average outcomes of students that that taught through Problem Based Learning Method (A_3)"

e. Based on the t test result, the obtained value of t_{hitung} in the amount of 9,09 > t_{tabel} is 1,66 at the significance level< $r = 0,05$, then H_0 is denied and H_1 is accepted. With the denied of H_0 so, it can be concluded that"the students' math learning outcomes that taught through Discovery Learning Method (A2) is better than the average students' outcomes that taught through Group Investigaation Method (A4)"

f. Based on the t test result, the obtained value of t_{hitung} in the amount of 16,90 > t_{tabel} is 1,66 at the significance level < $r = 0,05$, then H_0 is denied and H_1 is accepted. With the denied of H_0 ssso, it can be conclude that "the average of students' math learning outcomes that taught through Problem Based Learning (A3) is better than the average outcomes of students that taught through Group Investigation Method(A_4)".

Students' Error Analysis 01:
Students do not know that the hypothesis testing in one-way analysis of variance is using the **Fisher Test** statistic, where the test wants to see the four method of learning whether could

gives an influence or not, so, the statistic hypothesis that suitable to use is the Two Tailed test. Where this statistic test form as follow:

$H_0 : \mu_1 = \mu_2 = \mu_3 = \mu_4$

$H_1 : \mu_1 > \mu_2 > \mu_3 > \mu_4$

The mistake occurs when formulating the hypothesis, in this case, the student 01 does not use the word "significant" when formulating a research hypothesis. So it can be concluded that student 01 made a conceptual mistake but in principle and verbally, the students' answer is correct.

Analysis of Students' Interview Result

The analysis of students interview result aims to know more further and more detail about the difficulties that faced by the students in solving the questions related with the one way analyssiss of variance in applied statistic. The main concerned mistakes aare conceptual mistake, principle mistake, and operation mistake.

From the result of interviews on 3 students who become as the research subject is known the difficulties faced by students along with the causal factors. For more details, it will ssshown through the following interview clips:

Student Interview 01

Researcher   : In order to solving the one way analysis of variances problem, which part is considered as the difficult one?!

Student   : There are some steps, sir

Reseacher   : Named one of it, please!

Student   : Making the hypothesis formulation and statistical hypothesis

Researcher   : How come you said that?

Mahasiswa   : Sometime, the lecturer explain it too fast

Based on the interview clip above, it shows that actually the student 01is already understand the principle and verbal in solving problem, the student is only faced the error of concept understanding.

Student Interview 02

Researcher   : In solving the question in one way analysis variances (one way anova) which part that you considered as the difficult one?

Student   : There are some steps, sir

Researcher   : Could you name it, please?

Student   : I'm still confuse about which step that must be finished first. Is it finding the quadrate total value or finding the value of quadrate number between variant and the value of intern quadrate numbers.

Researcher   : How could you said that?

Student   : Hometime the lecturer does not give the previous questions that related with one way analysis of variances *(One Way Anova)*

Based on the interview clip above it can be seen that the student 02 actually already understood about concept and verbal in solving the question, the student facing the mistake in understanding the principle.

Students Interview 03

researcher   : in solving the question in one way analysis variances (one way anova) which part that you considered as the difficult one?

Student   : multiple comparison test, sir

Researcher   : please, named one if it.

Student   : determination of the formula that used in t-schefee test

Researcher   : how come you did not get it ?

Student   : sometime, the given question is different, so I did not noticed the number of samples, sir. So, I used the wrong formula

On the interview above, it can be seen that the student 03 is actually understood the concept and principle, the student is only having a mistake in understanding the verbal.

Analysis of Lecturer Interview Result

Based on the result of interview with the lecturer of applied statistic course, Mr. Tahir, S.Pd., M.Sc, it found several things as follow:

From the result of interview obtained, it can be seen that the factor that makes the students of Mathematics Education of SembilanBelas November Univertisity on the 2013 class feels so difficult in solving the questions of one way analysis of variance in applied statistics course is due to the lack of students' interest in learning. So that when studying the one way analysis of variance the student does not focusing on hiss attention on the material that being taught. In addition, the other factors that cause the students' difficulties that is due to the lack of students' basic knowledge of mathematical statistic I and mathematical statistic II and a unadequate handbook, and also the presence of fearness and embarrassment to ask .

The efforts that have been done by lecturer in order to overcome the students' difficulties in solving the question related to one way analysis of variences (one way anova) in applied statistic course, is: Lecturer tries to apply a better learning system in giving the material, convenient with the students condition in the classroom, so it can helps to increase the students learning interest. And also, lecturer asks to the students to work the question more often especially that related to one way analysis of variances (one way anova), so in the future, they will be able to make a good thesis which have a high difficult level of statistic.

2. Discussion

Based on data analysis about the students' difficulty in solving one way analysis of variances (one way anova) on applied statistic course shows that lots of students that facing a problem in understanding the concept, understanding and applying, and do an operation verbally. From the observation result found that the lecturer does not activate more the students in the learning process, and it caused many students that do not serious in following the lectures, so when lecturer gives the question, the students wwill having aa problem to finish it.

Things that cause the students have some problems in solving the question is the lack of learning interest in order to learn the applied statistic aand also the lack of students' understanding about the basic concept of mathematic statistic I and mathematic statistic II. The basic mathematic statistic that intended in this research is applied statistic concept that supposed to be mastery and can be applied by the students of class 2013 in solving the question matter because the basic concept of mathematic statistic I and mathematic statistic II was already learned before. As well as data centered size, size of data deployment, and the othe inferential analysis basis.

The students' difficulties in understanding the principle that found in this research is the student does not the rule or the formula that will used to solving aa questiong matter, or the student not be able to apply the formula that was already known in finishing a question matter. The other difficulty that was found in this research is difficulty in doing algorithm that can be shown from the students' answer which do not followed the procedure or steps in solving the formula of triangle in trigonometry, for example, a mistake in operation of multiplication and division in root form of fractional number.

In order to overcome the students' saturation then the lecturer should use the variative learning method. The implementing of variative learning method also can help the lecturer for more skilled in teaching. Besides that, a feedback aand motivation are also very important to increase the students' interest in learning.

From the result of assessment test, interview with the teacher and student shows that the factors that make the students having a problem in solving the triangle formulas is the lack of the understanding of the basic concept of mathematic, the lack of students' interst in learning mathematic, the presence of feaarness to ask even though they are not understand about the material

The effort that haad been done by the lecturer to overcome the students' difficulty in solving the triangel formulas in trigonometry such as: the lecturer tried to apply a better learning system in taught the material, convenient wwith the sstudents' condition in the classroom and can help to increase the students' interest in learning. Also, the lecturer suggested the students to provide the worksheet so they can practice more often even though they are not in the lesssons hours.

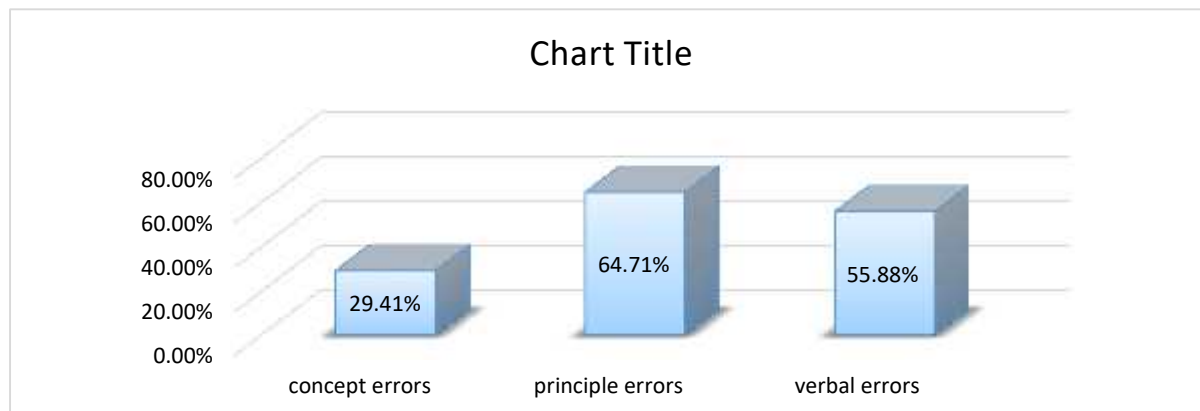The Results of the mistake kinds that done by the students is shown in this following figure 1:

Figure 1.Type error in solving the problem of one-way variance analysis

E. Conclusion

1. The difficulties that often experienced by the students in solving the one way analysis of variances (one way anova) on applied statistic course is the difficulty in understanding the concept and principle and it is difficult to apply and the concept and principle verbally, this is shown from the result of percentage,descriptively the types of student error that of 34 students there are 10 students with a percentage of 29,41% who made a conceptual mistake, whereas there are 22 students with a percentage of 64,71% who made a principle mistake, while a verbally that done by 19 students is 64,71%.

2. Main factor that causing the student facing some difficulties in solving the triangel formulas in trigonometry, is
    a) The lack of students' understanding on the besic concept of mathematic statistic I and mathematic statistic II which is very related to the one way analysis of variances (one way anova) material in applied statistic course.
    b) The lack of students' interest in learning the applied statistic is also very effect to the students' ability in solving the question matter of one way analysis of variances (one way anova).

3. The references book that owned by the students is inadequate.
    The efforts that have been done by lecturer in order to overcome the students' difficulties in solving the question related to one way analysis of variences (one way anova) in applied statistic course, is: Lecturer tries to apply a better learning system in giving the material, convenient with the students condition in the classroom, so it can helps to increase the students learning interest. And also, lecturer asks to the students to work the question more often especially that related to one way analysis of variances (one way anova), so in the future, they will be able to make a good thesis which have a high difficult level of statistic.

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