STUDENTS' DIFFICULTIES IN ANALYZING EXPERIMENTAL STATISTICS DATA

Oleh:
Iyan Irdiyansyah

ABSTRAK

Penelitian ini bertujuan untuk mengetahui kesulitan siswa dalam mata kuliah statistika terutama dalam merumuskan data statistik eksperimen. Metode deskriptif digunakan untuk menggambarkan dan menganalisis masalah yang dialami mahasiswa dalam statistik. Dokumentasi, kuesioner dan wawancara digunakan untuk mengumpulkan data. Adapun data tersebut menunjukkan bahwa siswa mengalami kesulitan dalam perhitungan data eksperimen. Ada faktor-faktor yang menyebabkan kesulitan dalam menghitung dan memformulasikan data statistik eksperimen. Pertama, mereka sangat jarang membaca pengolahan data statistik eksperimen. Kedua, rumus eksperimental lebih sulit dari rumus statistik lain. Untuk mengatasi hambatan ini, dasar matematika atau statistik harus dikuasi, penggunaan metode dan strategi pengajaran yang sesuai juga sangat dibutuhkan. Hal tersebut dapat mengubah perilaku mahasiswa terhadap mata kuliah ini. Selain itu, diskusi dengan teman sejawat dan perubahan persepsi dalam diri mahasiswa itu sendiri akan mempengaruhi percaya diri mereka terhadap perhitungan data statistik eksperimen.

Kata kunci: Metode deskriptif, kesulitan siswa, data statistik ekperimen

ABSTRACT

This paper is aimed to know students' difficulties in statistics especially in formulating experimental statistics data. Descriptive method is used to describe and analyze students' barriers in statistics. Students' work as documentation, questionnaire and interview are used for collecting the data. The data gained from the documentation, questionnaire and interview showed that the students got some difficulties in the experimental data calculation. There are factors that cause their difficulties in experimental statistics data calculation. First, they seldom read experimental statistic data processing. Second, the experimental formula is more difficult from others statistic formulas. Many tables should be prepared, and taking conclusion is also becoming students' difficulties. To overcome these barriers, basic of math or statistics, the use of suitable teaching and technique are needed very much. It may change students' behavior towards this material. Additionally, sharing to friends and students' perception change will affect their confidence towards experimental statistics data calculation.

Keywords: Descriptive Method, Students' difficulties, Experimental Statistics Data

INTRODUCTION

Writing a paper is considered as the requirement of graduation in higher education of country Indonesia. Every student should conduct research based on their learning focus. In writing the paper there are many processes.

Statistics as a discipline is the development and applications of methods to collect, analyze, and interpret data. Since data are used in most areas of human endeavor, the theory and methods of modern statistics have been applied in a wide variety of fields.

One of the important points that should be comprehended by the students is experimental design and its formula. Experimental design refers to a plan for assigning experimental units to treatment conditions. A good experimental design serves causation, control, and variability. There are statistical formulas for experiment: t-test formula, ANOVA one way, ANOVA two ways, and so on.

Negative responses to statistics are common among undergraduate students enrolled in a statistics lecture. Moreover, they are confused to calculate statistical formula into their research paper especially for those who conduct experimental research. They still do not understand how to use statistical formula accurately. They often feel difficult in calculating experimental formula. It is important for the students to learn statistics in order to be able to calculate the data accurately.

Based on the problem above, observation towards students is done to find out the cause of their difficulties in detail. Therefore, conducting the research on Students' Difficulties in Analyzing Experimental Statistics Data is needed to overcome their problem.

RESEARCH METHODOLOGY

Descriptive method is used in this research to gain insight; explore the depth, richness, and complexity inherent in the phenomenon. It is investigated an object that cannot be measured by numbers. In other words, this study aims to describe the nature of something that is ongoing at the time of the study. It is provided to complete information that is useful for the development of science and much more can be applied to various problems. It investigates and focuses on solving the problems that exist in the present. It is stated also by Neville (2007:8 in Scapens 1990) "where current practice is described in detail".

Seventh semester students of English Education Study Program are chosen as research site. It consists of six classes there are class A, B, C, D, E, and F. Two classes are chosen as participant based on the observation. The observation states that class C and F who have low understanding of experimental statistics data. Thus, C and F classes are chosen as participant purposively.

RESEARCH FINDING

As a research finding, it shows that 54% students admit that statistics is not a difficult subject and the rest confess that statistics is a difficult subject. As much as 96% students' answer that they never read statistics experimental data processing book. In addition, 96% states that they sharing is needed, 62% state that the experimental formula is more difficult than other. Based on the result above that students got difficulties in certain parts related to statistics.

DISCUSSION

Teaching is an activity of giving and guiding someone to know more about knowledge. Harmer (2001:56) says "Teaching means to give (someone) knowledge or to instruct or to train (someone)". The statement explains that teaching is an activity where teachers transfer the knowledge to the students. Moreover, the interaction is a sign of teaching learning process.

Additionally, Brown (2000:7) states that "teaching is showing or helping someone to learn how to do something, giving instruction, guiding in the study of something, providing with knowledge, causing to know or understand". In the other words, teaching is guiding someone to know and to develop the knowledge become something useful that is used in human life

In this modern era, Students and professionals both know that conducting accurate, valid, and timely research into academic topics such as history, literature, or anthropology is critical to success in the classroom and at work. Writing the results of the paper is also a major step in the process. The research is the systematic investigation and study of materials and sources to establish facts and reach new conclusions, so it shapes people's understanding of the world around them. Through research findings, psychologists are able to explain individuals' behaviors, including how people think and act in certain ways. This helps to determine disorders and their impact on the person and society. The researcher is required to be objective and hard effort to gain significant result. It is stated by Greener (2008:15) that the researchers try very hard and to be objective and balanced in their inquiries and their writing. However, there is no such thing as totally impersonal objective research.

There are kinds of the research such as qualitative and quantitative. Qualitative is required to the quality of research process and result. Qualitative data analysis involves organizing, accounting for and explaining the data; in short, making sense of data in terms of the participants' definitions of the situation, noting patterns, themes, categories and regularities. While quantitative data analysis is a powerful research form, emanating in part from the positivist tradition. It is often associated with large scale research, but can also serve smaller scale investigations, with case studies, action research, correlational research and experiments. Cohen, Manion and Marrison (2007:461.501). Quantitative gives direction to deal with a specific problem. Whether the problem is thoroughly solved or not is not the forte of the research work.

Sciences students, economics, psychology, social sciences, and medicine take introductory statistics. Statistics is increasingly offered at the high school level as well. In making predictions; Statistics uses the companion subject of Probability, which models chance mathematically and enables calculations of chance in complicated cases. Today, statistics has become an important tool in the work of many academic disciplines such as medicine, psychology, education, sociology, engineering and physics, just to name a few. Statistics is also important in many aspects of society such as business, industry and government. Because of the increasing use of statistics in so many areas of our lives, it has become very desirable to understand and practice statistical thinking. This is important even if we do not use statistical methods directly. However, statistics can be notoriously difficult to teach as it is seen by many students as difficult and boring, if not irrelevant to their subject of choice. It causes students do not understand.

Statistics is a mathematical tool for quantitative analysis of data, useful information from data will be extracted. Experimentation often generates multiple measurements of the same thing, i.e. replicate measurements, and these measurements are subject to error. Statistical analysis can be used to summarize those observations by estimating the average, which provides an estimate of the true mean. Another important statistical calculation for summarizing the observations is the estimate of the variance, which quantifies the uncertainty in the measured variable. Sometimes we have made measurements of one quantity and we want to use those

measurements to infer values of a derived quantity. Statistical analysis can be used to propagate the measurement error through a mathematical model to estimate the error in the derived quantity. Sometimes we have measured two different things and we want to know whether there really is a difference between the two measured values. Analysis of variance (t-tests) can be used to estimate the probability that the underlying phenomena are truly different.

Statistics is also taught in social, it is used as a tool to get valid data. Social students are not only using analysis and description but also doing some experiment to know the effectiveness or even the comparison. Statistics is not becoming taboo for social students; they only find some difficulties to understand more about statistic.

Teaching statistics to social students is not easy because teacher or lecturer should explain "What is statistic?", "What for?" even finding the suitable way of teaching statistics.

According to Singh (2006:271) "Usually word statistics carries the following three common meanings:

1. *In first place, it refers to numerical facts. State as well as Central, Statistical department and various other agencies can be seen engaged in collecting valuable statistics (numerical facts concerning the birth and death, school attendance, employment market, output of Industrial plants and Agriculture fields etc.*
2. *As a second meaning, word statistics refers to the method or methods of dealing with numerical facts. In this sense, statistics is taken as science of collecting, classifying, Summarizing, analyzing and, interpreting of numerical facts.*
3. *In its third meaning, statistics refers to the summarized figures of numerical facts such as percentage, averages, means, medians, modes, standard deviations etc. Each of these figures separately, (average or mean etc.) is referred to as 'Statistics'.*

The expert above describes the content of statistics, teacher or lecturer should tell the students that there are three meanings of statistics; it refers to numerical facts, it refers to a method of dealing with numerical fact and taken as a science to collect data, and it refers to the summarizing of figures of numerical data. These common meanings of statistics should be understandable by social students. It is basic for them to start studying statistics. Experiment is one of statistics design which consists of formulas. It is used to measure quantitative data derived after giving treatment. Treatment means giving a new method to sample in natural setting to know the reaction during teaching learning process. Cohen, Manion and Morrison (2007:274) state their statement related to design in educational experimentation;

There are several different kinds of experimental design, for example:

1. *The controlled experiment in laboratory conditions (the 'true' experiment): two or more groups.*
2. *The field or quasi-experiment in the natural setting rather than the laboratory, but where variables are isolated, controlled and manipulated.*
3. *The natural experiment in which it is not possible to isolate and control variables.*

Based on the statement above, there are the considerations of using experiment in the research. Natural situation, isolated, manipulated, and controlled variables should be considered. These are purposed to gain the valid data and valid findings.

Experimental statistics data are the data gained from the sample after doing treatments. It is analyzed and calculated based on the data. Data actually is a collection of information or information obtained from an observation; it can be a number, or a symbol of nature. The great data is the data that are representative, objective (according to what is or is happening), relevant (something to do with the issue which will be solved), has a high degree of accuracy or standard error. As stated by Boslaugh and Watters (2008:41) that the quality of analysis depends on the quality of the data.

Based on the observation derived from the field that statistics is taught in the seventh semester, the observation is done during teaching learning statistics in the class. It is found that students are very difficult to understand statistics calculation.

In daily research the usage of statistics has a very important role. Not only used for daily research purposes but also used to evaluate and to overcome students problem. However, nowadays also require statistics as a tool for calculating effective of teaching new method even calculating all quantitative research. Therefore, statistics cannot be separated from the research.

Students' difficulties in analyzing experimental statistics data are indicated to the background study of students. They come from various background of school where the students do not learn math at all. According to Ashadi (2009) in his research that "learning difficulties of students covers a broad sense, including: learning disorder, learning dysfunction, an under achiever, the slow learner, and learning disabilities". Ashadi says also that learning disorder is a condition in which one's learning process is interrupted because of the emergence of conflicting responses. Basically, who have a learning disorder, the potential is essentially not harmed, but the learning impaired or impeded by the presence of conflicting responses, so that the learning outcomes are achieved is lower than its potential.

Learning dysfunction is a symptom in which the learning process of the student is not functioning properly, despite the fact that the students did not indicate any mental sub normality, and other psychological disorders. Under Achiever actually refers to students who have a level of intellectual potential that falls above normal, but academic achievement is low. The statement describes the various concept of difficult learning. Through this research students' difficulties will be analyzed, and students' problem will be solved.

The research is conducted to know students' difficulties in analyzing experimental statistics data. This research is inspired from the other research which has been conducted in Greece. It was conducted by Dimitris Ghinis, Konstantinos Korres, and Sotiris Bersimis at University of Piraeus, Greece 2009. The result of their research as table follows:

Students' Identifying Difficulties in learning and teaching Statistics' Table

Statement	Frequency	%
Difficulties in learning Statistics		
1. Difficulty in understanding basic statistical concepts	6	3.7%
2. Difficulty in understanding assumptions and conclusions in statistical problems	22	13.5%
3. Difficulty in designing a solving procedure	43	26.4%

4. Difficulty in applying the appropriate statistical methodology and formulas	29	17.8%
5. Difficulty in checking the validity of the solving procedure	40	24.5%
6. Difficulty in applying known statistical methodology in real life situations and problems	59	36.2%
7. Difficulty in interpreting statistical results	6	3.7%
8. Difficulty in performing mathematical operations for extracting results	37	22.7%

The table shows that the most difficult in learning statistics are in understanding of assumption and conclusions 13.5 %, designing a solving procedure (calculating the formula) 26.4%, checking validity 24.5%, applying known statistical methodology in real life situation 36.2%, and performing mathematical operation for extracting result 22.7%.

This relevant research becomes reference for this research. The same research will be conducted to semester seventh students of English Education Study Program Faculty of Teachers and Educational Sciences Pakuan University. It is done because they have statistics lecture. It is hoped, by conducting this research students' problem are solved and students' difficulties are analyzed.

CONCLUSION

As a conclusion of this research, it can be concluded that the students who have taken statistics class in the seventh semester have difficulties in analyzing experimental statistics data. First, they seldom read experimental statistic data processing. Second, the experimental formula is more difficult from others statistics formula. Many tables should be prepared, and taking the conclusion is also becoming students' difficulties. To overcome these barriers, basic of math or statistics, the use of suitable teaching and technique are needed very much. It may change students' behavior towards this material. Additionally, sharing to friends and students' perception change will affect their confidence towards experimental statistics data calculation.

BIBLIOGRAPHY

Brown, H. Douglas. 2000. *Teaching by Principles: an Interactive Approach to Language Pedagogy.* San Francisco California. Longman.

Harmer, Jeremy. 2001. *The Practice of English Language Teaching*. San Francisco California: Longman

Neville Colin. 2007. *Effective Learning Service: Introduction to Research and Research Methods*. Bradford University.

Boslaugh Sarah and Watters A. Paul. 2008. *Statistics in a Nutsheel*. O'reilly. United State of America.

Seltman J. Howard. 2014. *Experimentl Design and Analysis*. Carnegie Mellon University, Pittsburgh. United State of America.

Singh K. Yogesh. 2006. *Research Methodology and Statistics*. New Age International (P) Limited Publisher, New Delhi.

Greener Sue. 2008. *Business Research Methods*. Ventus Piblishing ApS.

Cohen L., Manion Lawrence, and Morrison K. 2007. *Research Methods in*

Education. Rountledge, Canada USA.

Ghinis G., Korres K. and Bersimis S. 2009. *Difficulties Greek Senior High School Students Identify in Learning and the Teaching of Statistics: The Case of Experimental and Private High Schools. Journal of Statistics Education* Volume 17, Number 3 (2009), www.amstat.org/publications/jse/v17n3/ghinis.html

Ashadi. 2009. *Kesulitan Belajar Kimia Bagi Siswa Sekolah Menengah*. UPT Perpustakaan UNS. http://pustaka.uns.ac.id

AUTOBIOGRAPHY

Iyan Irdiyansyah, is a lecturer of Statistics in Language Study, Research on ELT and Learning Evaluation of English Education Study Program, Faculty of Teacher Training and Educational Sciences. Pakuan University.