



Students' Ability to Understand Statistics Subjects: An Analytical Review

Zainudin MZ

Departemen of Management, Faculty of Economics Islamic University of Kadiri, Kediri

Corresponding Author: Zainudin MZ zainudin44@uniska-kediri.ac.id

ARTICLE INFO

ABSTRACT

Keywords: Ability, Knowledge, Statistic

Received : 12, November

Revised : 15, December

Accepted: 26, January

©2024 Zainudin: This is an open-access article distributed under the terms of the [Creative Commons Atribusi 4.0 Internasional](https://creativecommons.org/licenses/by/4.0/).



This research aims to assess the comprehension skills of students in the statistics course at the Management Study Program, Universitas Islam Kadiri, Kediri. A survey method was employed to gather diverse information from 30 students in Semester III class A5 enrolled in the statistics course during the academic year 2022/2023. The research was conducted from July to November 2023, utilizing purposive sampling. Data collection involved a test comprising 10 multiple-choice questions, focusing on stages such as reading comprehension, understanding, transformation, process skills, and selecting the correct answers. Qualitative descriptive analysis was applied during and after data collection. The research findings indicate that students' comprehension skills in the statistics course fall into the high category, with 62% of students answering correctly. Common errors occurred in stages such as reading comprehension, understanding, transformation, process skills, and answer selection. Suggestions are given to students to study more diligently, actively participate in learning activities, and overcome difficulties by finding ways to make statistics materials more comprehensible. The Management Study Program is advised to pay special attention to challenging statistics topics to optimize students' learning outcomes.

INTRODUCTION

Essentially, education is an effort to prepare learners to face a rapidly changing environment (Rahayu et al., 2014). According to Law No. 20 of 2003 on National Education System (SISDIKNAS), education is a conscious and planned effort to create a learning atmosphere and a learning process so that students actively develop their potential in spiritual and religious strength, self-control, personality, intelligence, noble character, and skills needed for themselves and society (Nggema et al., 2020). The general goal of education is to provide an environment that facilitates students in developing their abilities optimally, in line with personal and societal needs (Firmansyah, 2017).

The transition of students from high school to higher education entails a significant change in roles. Students are no longer solely focused on their education; rather, their ability to develop their knowledge is highly valued in higher education. The responsibilities of students are encapsulated in the three pillars of higher education, known as "tri dharma perguruan tinggi" (Nurlita, 2018). These pillars encompass education, research, and community service, which are interrelated and should be implemented simultaneously.

Research, as one of the pillars of higher education, is the implementation of knowledge acquired during the education process in higher education. Through research, students enhance their proficiency in their academic discipline, gaining deeper understanding and contributing to the enrichment of their knowledge. The research findings become valuable for the development of their academic discipline.

Statistics plays a crucial role in addressing research questions. It aids researchers in determining whether observed differences or relationships are significant. Statistics ensures that conclusions drawn are representative and provide accurate information (Nurlita, 2018). In the realm of education, especially in higher education, statistics is essential for solving problems in both qualitative and quantitative research (Jais & Amiati, 2020). The Statistics course is a mandatory subject taught in almost every program of study at the university level. Its objective is to enable students to comprehend statistical concepts and procedures, applying them to analyze research problems (Afifah & Wicaksana, 2014).

The significance of students' comprehension of statistics is crucial, particularly for senior-level students (Payadnya et al., 2020). However, based on observations from 2021 to 2022, statistics courses are often perceived as daunting by students due to the calculation-intensive nature of the material.

The low proficiency of students in statistics is evident in their mastery of the provided material. To assess students' proficiency, tests or questions related to the material are administered. Students' errors in solving problems serve as indicators of their mastery of the subject matter (Sangila & Jufri, 2018).

According to the findings of Suryana (2015), students' mathematical proof-reading abilities in the Mathematical Statistics course are still considered insufficient. Some students face difficulties in understanding the flow of a proof, including challenges in verifying the accuracy of the proof and

articulating the concepts used. This comprehension skill needs to be reassessed by researchers.

This research aims to assess the extent of comprehension skills among management program students in the context of the 2022/2023 academic year, currently in their third semester, regarding statistics when presented with statistical questions. All answers, correct or incorrect, are evaluated by the researcher. Assessing students' comprehension skills in answering statistical questions requires focused research on their understanding of the "Statistics" course. For third-semester students, learning the basics of statistics is crucial because statistics is highly beneficial when conducting research. The statistics course is closely related to research, as statistics plays a vital role in model development, hypothesis formulation, instrument and data collection tool development, research design, sample determination, and data analysis. The important objectives of this research are to:

1. Evaluate the extent to which students understand basic concepts in the statistics course.
2. Identify specific areas that may pose challenges to students' comprehension of statistical material.

THEORETICAL REVIEW

1. The Understanding of Statistical Reasoning

According to the Indonesian Dictionary (KBBI), reasoning is the manner of using reason; logical thinking or logical thought process; the scope of thought. Nurmanita (2017) defines reasoning as a thinking activity to draw conclusions or make new statements that are true and based on previously proven statements by connecting existing facts. One of the goals of mathematics learning in the 2013 curriculum is the development of reasoning skills in learners by training logical thinking and reasoning to draw conclusions. Depdiknas (2006) states that reasoning ability is one of the goals in mathematics learning at schools, aiming to train logical thinking and reasoning to draw conclusions, develop problem-solving skills, and enhance the ability to convey information or communicate ideas through oral, written, visual, and graphical means. Reasoning skills emerge when someone thinks about how to solve a problem or draw conclusions by providing reasons for the problem. The focus in this research is on statistical reasoning skills. del Mas in Yusufita (2017) states that statistical reasoning is the ability to explain why and how a result is produced and why and how conclusions are drawn. Olani, et al., in Maryati (2017) mention that statistical reasoning refers to the ability to understand and integrate statistical concepts and ideas to interpret statistical processes and results. Meanwhile, Dasari in Negara, et al., (2019) defines statistical reasoning as the ability to draw conclusions and provide explanations based on data orientation, considering structured and unstructured procedures, statistical concepts, and critically commenting on a statistical process or result. Maryati (2017) further explains that statistical reasoning is the ability of students to understand various information found in everyday life, including their ability to collect, process, present, and represent data.

2. The Phenomenon of Statistic Interpreting

Statistics is a branch of science that plays a crucial role in collecting, analyzing, and interpreting data to obtain meaningful information. Understanding statistics goes beyond mastering mathematical formulas; it involves the ability to connect these concepts with real-world contexts. Through statistics, we can explore and explain patterns emerging from data, identify trends, and make predictions based on available information. Statistical understanding enables individuals to make informed and intelligent decisions, both in academic and professional contexts. With this skill, individuals can unravel the complexity of data, construct arguments based on empirical evidence, and make more accurate decisions. Therefore, statistical understanding is not just a technical skill but also a key to engaging in real-world problem-solving with a rational and informed approach. Despite the crucial nature of statistical understanding, there is a research gap that needs to be addressed. Some students may struggle to relate statistical concepts to practical applications in their daily lives or fields of study. Moreover, the lack of understanding regarding factors influencing students' levels of understanding of statistics remains partially explored. The unclear impact of specific teaching methods on students' understanding and the lack of strategic recommendations to enhance the effectiveness of statistical learning are other aspects that need further exploration. Therefore, further research is needed to fill these gaps, focusing on the development of innovative teaching strategies, a more detailed identification of influencing factors, and a deeper discussion of the connection between statistical understanding and practical applications in various contexts. Through such research, solutions are expected to be found that can enhance the quality of students' understanding of statistics, positively impact their analytical abilities, and support better decision-making in various life domains.

METHODOLOGY

This research employs a survey method as the researcher seeks extensive and diverse information to describe students' understanding of the statistics course. The study is conducted in the Management Study Program at Universitas Islam Kadiri, Kediri. The data collection period is from July to November 2023. The population consists of third-semester students (Class A5) in the Management Study Program who enrolled in the statistics course for the academic year 2022/2023, totaling 30 students. Sampling is done using purposive sampling. The data collection technique involves measurement, using statistical questions in the form of a test to analyze students' abilities in solving research cases. The data collection instrument is a test comprising 10 multiple-choice questions to measure students' understanding of mathematical statistics. Qualitative descriptive analysis is used for data analysis, conducted during and after data collection to systematically organize and interpret data according to the research problem. To assess the level of statistical knowledge understanding, the test results are described and categorized as shown in the following table:

Table 1. Categories of Students' Basic Statistical Understanding Levels at the Beginning of the Statistics Course

No.	Student Score	Category
1	0,00 – 20,00	Very Low
2	20,01 – 40,00	Low
3	40,01 – 60,00	Moderate
4	60,01 – 80,00	High
5	80,01 – 100,00	Very High

Source : Data Processed, 2023

RESULTS

1. Description of Research Results

In this study, the data obtained by the researcher consists of two types: quantitative data and qualitative data. Quantitative data analysis is conducted by examining and checking students' answers, followed by counting the number of questions solved by students to measure their understanding abilities. In the qualitative data analysis or data description, the focus is on the level of understanding ability and the location of students' understanding errors in the statistics course at the Management Study Program of Universitas Islam Kadiri, Kediri.

2. Level of Students' Understanding Ability

After students are ready to answer statistical questions, the researcher examines their answers to see the number of students who answered correctly and incorrectly for each question. The overall results of students' answers from all research participants or test takers can be seen in the following table:

Table 2. Results of 30 Students' Answers to 10 Statistical Questions

No.	Answer	Total
1	True (%)	186 (62%)
2	False (%)	114 (38%)
	(%)	300 (100%)

Source : Data Processed, 2023

Based on the table above, there are 10 questions given to 30 research respondents, making a total of 300 questions. The responses of students who answered correctly are 186 questions or 62%, and the responses of students who answered incorrectly are 114 questions or 38%. The results of students' achievement tests from 30 respondents are summarized in the following table:

Table 3. Outer Loading Antar Variabel

No.	Statistical	Value
1	Respondents	30
2	Ideal Score	100
3	Highest Score	100
4	Lowest Score	20
5	Average	62
6	Standart Deviation	22,49

Source : Data Processed, 2023

Based on the table and diagram above, the average score obtained is 62 with a standard deviation of 22.49. The highest score achieved by students is 100, while the lowest score is 20, from the ideal score of 100. Thus, the level of students' understanding ability in the statistics course at the Management Study Program of Universitas Islam Kadiri, Kediri, is in the range of 60-80%, specifically 62%, categorized as high.

Based on the analysis of the test conducted by the researcher, the location of students' understanding errors in the statistics course for 10 questions based on the previously studied statistical material is as follows:

Tabel 4. Output Akar (AVE)

No	Jawaban	Nomor Soal									
		1	2	3	4	5	6	7	8	9	10
1	Benar	27	14	23	13	15	22	17	8	24	23
		(90)	(46,7)	(76,7)	(43,3)	(50)	(73,3)	(56,7)	(26,7)	(80)	(76,7)
2	Salah	3	16	7	17	15	8	13	22	6	7
		(10)	(53,3)	(23,3)	(56,7)	(50)	(26,7)	(43,3)	(73,3)	(20)	(23,3)
Total (%)		30 Responden (100%)									

Source : Data Processed, 2023

DISCUSSION

1. Level of Students' Understanding Ability

Based on the research analysis using a sample of 30 students, the results of students' answers in the statistics course indicate that the level of students' understanding ability can possibly change if the students study diligently and earnestly. Out of the entire sample, 62% answered the questions correctly, while 38% answered incorrectly. From these results, it can be observed that the percentage of students answering correctly is higher than those answering incorrectly. The analysis of answers from the 10 statistical basic comprehension questions administered to the tested students shows that the level of students' basic statistical understanding in the statistics course of the Management Study Program at Universitas Islam Kadiri, Kediri, falls into the high category. This is based on Table 2, which indicates that the average of students' answers to the 10 questions is 62%. Out of the 10 questions given to the 30 research respondents, totaling 300 questions, the responses of students who answered correctly are 186 questions, or 62%.

2. Location of Students' Understanding Errors

Based on the results of descriptive analysis, the extent of students' understanding errors in the statistics course at the Management Study Program of Universitas Islam Kadiri, Kediri, for the 10 questions varies for each question, both in general for all students and based on each question or topic. Table 4 shows that the percentage of correctness and error in students' knowledge understanding differs. Generally, the errors in students' understanding of the 10 statistical questions rank first in question number 8 about inferential statistical case problems. In this inferential statistics question, 26.7% of students answered correctly, while 73.3% answered incorrectly. The second-ranking question with

significant understanding errors is question number 4, which is about the definition of inferential statistics. In question number 4, 43.3% of students answered correctly, and 56.7% answered incorrectly. In questions 8 and 4, students have a lack of mastery of the concepts of inferential statistics, resulting in more incorrect answers. The third-ranking question with significant understanding errors is question number 2 about the definition of descriptive statistics. In question number 2, 46.7% of students answered correctly, and 53.3% answered incorrectly. In question number 2, students have less understanding and mastery of descriptive statistics concepts, resulting in more incorrect answers. The fourth-ranking question with significant understanding errors is question number 5 about the mean or average value. In question number 5, 50% of students answered correctly, and 50% answered incorrectly. This means that in question number 5, 15 students (half of the total respondents) have a poor understanding of the formula and calculation of the average value in a case problem.

The research results indicate that some students still tend to answer statistical questions incorrectly. This implies that students face challenges at various stages, including reading the questions, understanding them, transforming information, applying process skills, and selecting the correct answers.

1. Reading Errors: Occur when students read the questions too quickly without fully understanding them, leading to an inability to answer the statistical questions correctly.
2. Comprehension Errors: Happen when students can read the questions but fail to comprehend them, resulting in confusion or failure to answer the questions accurately.
3. Transformation Errors: Arise when students understand the questions correctly but fail to identify the appropriate statistical formulas to solve the problems. This error may occur due to a misunderstanding of concepts or a lack of knowledge about the concepts used in solving the problems.
4. Process Skills Errors: Take place when students can correctly identify statistical formulas and concepts but fail to execute the procedures accurately. Despite reading and understanding the questions correctly, students may make procedural errors in calculations or lack precision in their computations.
5. Answer Selection Errors: Occur when students can solve problems correctly but fail to choose the correct answers. Some causes of this error include carelessness in calculations, reluctance to read and understand questions, resulting in the selection of incorrect answers. Errors in drawing conclusions, failure to check the calculation results, concepts, and answers given lead to mistakes in selecting the final answers, as students may not review what is being asked, resulting in errors in selecting the final answers.

Factors contributing to students' inability and lack of understanding in answering statistical questions provided by the researcher consist of two main internal factors: the student's physical condition (such as poor health, reluctance

to ask questions, failure to review previously learned materials, lack of talent in calculations, inadequate initial understanding of statistical concepts, low interest and motivation in the learning process, poor study habits focusing more on memorization than understanding, inadequate understanding of statistical symbols and formulas, low intellectual capacity/intelligence, and insufficient understanding and recall of previously learned statistical materials). External factors include the lack of parental attention to a child's education, an unfavorable environment, frequent engagement with social media platforms, gaming, and socializing (staying up late), leading to forgetting to study. Moreover, students may be influenced by delinquent friends and have a lack of motivation to learn.

CONCLUSIONS AND RECOMMENDATIONS

Based on the research analysis and discussion, it can be concluded that the level of students' understanding ability in the statistics course at the Management Study Program of Universitas Islam Kadiri, Kediri, falls into the high category at 62%. Referring to the entire sample, 62% answered the questions correctly, while 38% answered incorrectly, indicating that the percentage of students answering correctly is higher than those answering incorrectly. The research results reveal that errors in answering statistical questions occur because students face challenges at various stages, including reading questions, comprehension, transformation, process skills, and selecting the correct answers. Recommendations for the Management Study Program of Universitas Islam Kadiri, Kediri, Semester IIIA5, include encouraging students to study statistics diligently, actively participating in every learning activity, and not solely focusing on the concepts taught by lecturers. Difficult statistical material should not be left unattended; instead, efforts should be made to make difficult statistical topics more accessible for optimal learning outcomes.

FURTHER STUDY

Further studies in this research area can delve into several aspects to enhance the understanding of statistical comprehension among students. Firstly, investigations can focus on exploring innovative teaching strategies to address the identified challenges, such as reading errors, comprehension errors, transformation errors, process skills errors, and answer selection errors. Assessing the effectiveness of different teaching methods and tools may contribute valuable insights for educators to tailor their approaches to students' needs. Secondly, future research can delve deeper into the internal factors affecting students' statistical comprehension, such as health conditions, learning habits, and cognitive capacities. Understanding these factors more comprehensively can guide the development of targeted interventions to improve students' learning experiences. Additionally, exploring the impact of external factors like parental involvement, social media usage, and peer influence on students' statistical understanding can provide a more holistic view of the challenges students face. Lastly, longitudinal studies can be conducted to observe the long-term effects of improved teaching methodologies

and interventions on students' statistical comprehension, providing valuable data on the sustainability of these educational enhancements.

ACKNOWLEDGMENT

I would like to express my sincere gratitude to all those who contributed to the completion of this research. First and foremost, I extend my heartfelt appreciation to my supervisor for their guidance, valuable insights, and unwavering support throughout the research process. Special thanks to the participants who willingly took part in the study, providing essential data for analysis. I am also thankful for the cooperation and assistance received from the academic staff and administrators of the Management Study Program at Universitas Islam Kadiri, Kediri. Furthermore, I appreciate the encouragement and understanding from my family and friends, whose support has been a constant source of motivation. This research would not have been possible without the collaborative efforts and encouragement of everyone involved.

REFERENCES

- Afifah, S. N., & Wicaksana, E. J. (2014). Persepsi Mahasiswa tentang Mata Kuliah Statistik serta Pengaruhnya terhadap Prestasi Belajar Statistik Mahasiswa IKIP PGRI Madiun. *Jurnal CARE*, 2(1), 1–8.
- Firmansyah, M. A. (2017). Analisis Hambatan Belajar Mahasiswa Pada Mata Kuliah Statistika. *Jurnal Penelitian Dan Pembelajaran Matematika*, 10(2). <https://doi.org/10.30870/jppm.v10i2.2036>
- Jais, E., & Amiati, W. (2020). Jurnal akademik pendidikan matematika. *Akademik Pendidikan Matematika*, 6(November), 62–66.
- Maryati, I. (2017). Analisis Kesulitan Dalam Materi Statistika Ditinjau Dari Kemampuan Penalaran Dan Komunikasi Statistis. *Prisma*, 6(2), 173–179. <https://doi.org/10.35194/jp.v6i2.209>
- Nggema, A. R., Indrawan, I. P., & Yesy, A. N. L. P. (2020). Analisis Pelaksanaan Pembelajaran Daring di Tengah Pandemi Covid-19 dalam Mata Pelajaran Matematika pada Siswa Kelas VIII SMP Santo Yoseph Denpasar. *Jurnal Emasains: Jurnal Edukasi Matematika Dan Sains Volume*, IX(2), 241–265. <https://infeksiemerging.kemkes.go.id/%0Ahttps://ojs.ikipgribali.ac.id/index.php/emasains/article/view/847>
- Nurlita, M. (2018). Analisis Kemampuan Pemahaman Pengetahuan Mahasiswa. 4(November), 46–56. <https://doi.org/10.17605/OSF.IO/JPZ2F>
- Payadnya, I. P. A. A., Noviyanti, P. L., & Wibawa, K. A. (2020). Analisis Kemampuan Pemahaman Konsep Mahasiswa pada Mata Kuliah Metode Statistika I selama Pandemi COVID-19. *Jurnal Emasains: Jurnal Edukasi Matematika Dan Sains*, IX(2), 288–296.

- Rahayu, S., Harjono, A., Sutrio, S., Gunada, I. W., & Hikmawati, H. (2014). Pengembangan Modul Pengantar Statistik Deskriptif Pada Mata Kuliah Statistik Dasar Untuk Mahasiswa Pendidikanfisika Universitas Mataram. *Lensa: Jurnal Kependidikan Fisika*, 2(1), 168. <https://doi.org/10.33394/j-lkf.v2i1.309>
- Sa'idah, N. (2016). Problematika Kesulitan Belajar Statistik. *Proseding Seminar Nasional PGSD UPY*, 54–61.
- Sangila, M. S., & Jufri, L. (2018). Deskripsi kemampuan mahasiswa fakultas tarbiyah dan ilmu keguruan kendari dalam menganalisis data statistika. *Jurnal Al-Ta'dib*, 11(1), 109–126.
- Suryana, A. (2015). Analisis Kemampuan Membaca Bukti Matematis Pada Mata Kuliah Statistika Matematika. *Infinity Journal*, 4(1), 84. <https://doi.org/10.22460/infinity.v4i1.74>