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PROCEDURAL UNDERSTANDING THROUGH A SCREENCAST PROJECT

Lena Wahyu Trisna Alviana[1], Rahel Alya Rhezwanda[2]*, Yerry Soepriyanto[3]

State University of Malang, Jl. Semarang No. 5 Malang, East Java, Indonesia

*Author of correspondence, Email: rahel.alya.2401216@students.um.ac.id

Abstract

Procedural understanding is very important in statistics courses. This study measured the level of students' procedural understanding of Educational Statistics material through a screencast project with a quantitative descriptive method. The results of the exam analysis showed that cognitive thinking ability C2, which focuses on procedural understanding, received the main attention. The highest percentage of correct answers for C2 questions reached 88.33%, with the most frequently answered questions being about how to conduct a two independent samples t-test analysis. This shows students' good understanding of specific statistical analysis procedures. In conclusion, students' procedural understanding of the Educational Statistics material can be effectively measured through the screencast project. These results indicate that screencast is an effective method to improve procedural understanding in the context of statistics education. The integration of this technology allows students to learn independently, increases their engagement in the learning process, and deepens their understanding of the material taught. These findings are consistent with previous research that shows the great potential of multimedia, including screencasts, in education, especially for complex subjects such as statistics.

Keywords: Educational Statistics, Procedural Understanding, Descriptive Quantitative.

1. Introduction

The Educational Statistics course is a crucial component of the Educational Technology study program curriculum, designed to provide students with a deep understanding of basic and advanced statistical concepts essential for conducting educational research and data analysis. However, one of the main challenges students face is procedural understanding, namely the ability to apply statistical steps appropriately and consistently in their research. Students often struggle to master relevant statistical techniques for solving various educational research problems, including descriptive, inferential, and regression analysis. Statistics helps educators and researchers understand and evaluate research data so they can make informed decisions based on empirical evidence (Sudjana, 2002). This course also teaches the application of statistical theory in real-world situations, including the use of software such as SPSS, R, or Python to analyze complex educational data. The use of statistical software can improve the efficiency and accuracy of data analysis, which is essential in modern educational research (Trihendradi, 2017). However, to achieve a deep understanding and adequate analytical skills, students need to develop strong procedural knowledge to integrate statistical concepts and techniques into real-world practice, ensuring the validity and reliability of their research results.

Procedural understanding in educational statistics courses refers to students' ability not only to understand statistical concepts but also to apply statistical procedures appropriately in educational contexts. According to , this ability is crucial because it helps students complete research assignments systematically and data-drivenly, resulting in valid and reliable findings. Edwards' theory reinforces this by stating that procedural understanding involves internalizing the rules and steps required to complete a task, encompassing declarative knowledge, procedural knowledge, and conditional knowledge. In the context of educational statistics, students must be able to plan, collect, analyze, and interpret statistical data appropriately based on the circumstances and needs of their research. This ability ensures accurate data analysis and reliable research results, which in turn improves the overall quality of educational research. Thus, procedural understanding is a key foundation in developing students' analytical skills in the field of education.

Through screencasts, instructors can record the steps involved in performing a specific task, allowing students to view and follow the process anytime and anywhere. Research by (Soepriyanto et al., 2021) shows that the use of screencasts can significantly improve students' procedural understanding. With screencasts, students can control their learning pace, repeat difficult sections, and practice the steps taught according to their individual needs. This aligns with the theory of self-directed learning, which emphasizes the importance of learning at each student's own pace and style. Therefore, integrating screencasts into Educational Statistics learning not only supports technical mastery but also deepens students' procedural understanding. The use of screencasts allows students to replay the footage repeatedly during lab work or independent study, helping them master the material more effectively and increasing their motivation to learn.

In the context of Bloom's Taxonomy, screencasts help students at various levels of learning, from remembering basic information to applying and analyzing the procedures taught. Bloom's Taxonomy is a framework used to

classifies learning objectives into six levels, ranging from the simplest to the most complex (Anderson & Krathwohl, 2001). In the context of statistics learning, Bloom's taxonomy is highly relevant in developing students' procedural understanding. At the understanding level (C2), students must be able to explain and interpret the statistical concepts they are learning. By emphasizing this level of understanding, instructors can design activities and tests that challenge students to demonstrate their ability to understand procedural steps and apply statistical techniques in various contexts. This ensures that learning objectives are achieved effectively and efficiently, helping students master the procedural fundamentals necessary for statistics.

The research problem formulation in this study is the level of students' procedural understanding of educational statistics material through a screencast project. And the purpose of this study is to measure the level of students' procedural understanding of Educational Statistics material through a screencast project.

2. Method

This study used the quantitative descriptive research method. This method aims to systematically and accurately describe the characteristics of a population or phenomenon (Creswell, 2009). In this method, researchers collect data from samples selected from a specific population and use descriptive statistics to analyze and present the results. Descriptive statistics include the use of tools such as mean, median, mode, and frequency distribution to provide an overview of the collected data (D. Sugiyono, 2013).

Data collection in this study was conducted using a questionnaire consisting of 35 questions. The study population was 126 educational technology students from the 2022 intake, and the sample size was 60 students from offerings A and B. The sampling technique used allowed the researcher to obtain an accurate representation of the population, allowing the research results to be generalized to the entire population studied.

A research instrument is a tool used to collect data in a study. This instrument is designed to measure the variables in the study. In the context of this study, the instrument used is a questionnaire, which is a series of questions or statements designed to gather information from respondents (P. P. Sugiyono, 2016). This questionnaire consists of 35 questions grouped according to indicators in Bloom's taxonomy theory. A total of 5 questions are designed to measure conceptual understanding (C1), 25 questions to measure application skills (C2), and 5 questions to measure analytical skills (C3) (Anderson & Krathwohl, 2001). In this research, data analysis techniques are a crucial stage after all respondents have been obtained. This process begins by grouping data based on types and aspects relevant to the research objectives. This allows researchers to more easily analyze and interpret the data obtained from the questionnaire. According to (Creswell, 2009), organizing data based on specific categories or themes can help understand emerging patterns and trends. Furthermore, by using appropriate analysis techniques, researchers can present research results in a clear and structured description, making it easier for readers to better understand the research findings.

3. Results and Discussion

3.1 Result

The results section contains research findings obtained from research data and related to the hypothesis.

Level	Number of Questions	Highest Percentage Correct	Lowest Percentage Correct	Average Percentage	Percentage of Students
C1	5	91.66666667	46.66666667	42.2	25.32
C2	25	88.3333333	5	40.64	24.384
C3	5	90	6.666666667	30.4	18.24

This study examines students' academic performance through the final semester exam in the Educational Statistics course. The research instrument was developed by referring to three indicators of cognitive thinking ability: C1, C2, and C3. The questionnaire instrument consists of 35 questions, which are divided into 5 questions with C1 indicators, 25 questions with C2 indicators, and 5 questions with C3 indicators. The following is a breakdown of the percentage of correct scores for each question category: For category C1 with 5 questions, the highest percentage of correct answers is 91.67%, the lowest percentage of correct answers is 46.67%, the average percentage of correct answers is 42.2%, and the percentage of students who achieved this score is 25.32%. In category C2 consisting of 25 questions, the highest percentage of correct answers is 88.33%, the lowest percentage of correct answers is 5%, the average percentage of correct answers is 40.64%, with the percentage of students reaching 24.384%. For category C3 which has 5 questions, the highest percentage correct is 90%, the lowest percentage correct is 6.67%, the average percentage correct is 30.4%, and the percentage of students is 18.24%.

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From the descriptive statistical data of student scores, the following results were obtained: By referring to these indicators, we can calculate the percentage of the total sample to determine the highest and lowest correct scores, as well as the average score of students with the highest and lowest correct scores. The percentage of students with the highest score (more than 89) is zero because the maximum score obtained is 89, so no student obtained a score more than 89. Similarly, the percentage of students with the lowest score (less than 31) is zero because the minimum score obtained is 31, so no student obtained a score less than 31. To determine the average score of students with the highest and lowest correct scores, we need to look at the average score of each question category, namely the average score for C1 is 42.2%, for C2 is 40.64%, and for C3 is 30.4%. From this data, we can calculate the average score of each question category for students with the highest and lowest scores.

From the data obtained, the maximum score is 89 and the minimum score is 31. This shows a significant variation in student achievement, where the maximum score indicates that there are students who have a very good understanding of the material, while the minimum score indicates that there are students who still have difficulty understanding the material. The mode score of 77 shows that the most frequently occurring score is 77, which is a fairly good score. The median score of 70.50 shows that half of the students have scores below 70.50 and half above that score.

The average score of 67.78 indicates that the students' general performance is above the passing grade. The standard deviation of 15.1210838 indicates a significant variation in students' scores, indicating that there are significant differences in students' levels of understanding. From the percentage of correct scores for each question category, it can be seen that question C1 has the highest correct percentage which is quite high (91.67%), while question C3 has the highest correct percentage which is also high (90%). However, the lowest correct percentages for question C2 (5%) and question C3 (6.67%) indicate a gap in understanding of the material being tested.

This study aims to measure the level of understanding of Educational Technology students' procedural knowledge regarding Educational Statistics material through a screencast project. From the analysis of the exam results, the cognitive thinking ability indicator C2, which focuses on procedural understanding, is the main focus. The highest percentage of correct answers for question C2 was 88.33%, with the question most answered correctly being "Which way to conduct a two-sample independent t-test analysis?". This indicates that students have a good understanding of specific statistical analysis procedures.

3.2 Discussion

This study aims to measure the level of procedural understanding of Educational Technology students regarding Educational Statistics material through a screencast project. Based on the results of data analysis, the cognitive thinking ability indicator C2, which focuses on procedural understanding, showed prominent results with the highest percentage of correct answers at 88.33%. The most frequently answered question in this category was "Which way to conduct a two-sample independent t-test analysis?". This indicates that students have a good understanding of specific statistical analysis procedures, which is the core of this study.

The results of this study can be linked to Bloom's Taxonomy theory, which classifies educational objectives into several levels of cognitive ability, ranging from basic knowledge to evaluation. Bloom's Taxonomy revised by (Anderson & Krathwohl, 2001) divides educational objectives into two main dimensions: the knowledge dimension and the cognitive process dimension. The knowledge dimension includes facts, concepts, procedural, and metacognitive, while the cognitive process dimension includes remembering, understanding, applying, analyzing, evaluating, and creating. In the context of this study, the focus on indicator C2 places students' procedural understanding at the 'Applying' and 'Analyzing' levels in Bloom's taxonomy. The 'Applying' level requires students to use the information they have learned in new situations or specific problems, while the 'Analyzing' level requires the ability to break down information into smaller parts and understand how these parts relate to each other and to the overall structure.

The question "Which way to perform a two-sample independent t-test analysis?" requires students to apply their statistical knowledge and analyze the appropriate procedure for a given situation, demonstrating their ability to apply and analyze the concepts they have learned. The high percentage of correct answers on this question indicates that students have a strong understanding of the statistical procedures taught. Several other studies have shown that multimedia, including screencasts, can improve students' procedural understanding.

(Mayer, 2009)found that the use of multimedia can enhance student comprehension by providing visual and verbal representations of complex information. According to (Mayer, 2009), multimedia learning theory supports the idea that when words and images

When combined, students' understanding deepens compared to using only one type of media. This finding aligns with the results of this study and supports the importance of deeper procedural understanding. Research by (Kay, 2012) also shows that instructional videos and screencasts can help students better understand difficult material, provide opportunities for independent study, and allow them to review the material as needed.

Furthermore, research by (DeVaney, 2009)showed that students who used video tutorials in statistics lessons reported improvements in their comprehension and analytical skills. This confirms that screencasts can improve students' procedural understanding of statistical material, in line with the findings of this study. Thus, screencasts can be considered a very useful tool in the context of statistics learning. According to research published in the Journal of Educational Technology, State University of Malang, the use of screencasts in learning has been shown to increase student active participation and deepen their understanding of the material being taught.

These results reinforce the finding that screencasts are an effective learning tool in higher education contexts, particularly in teaching statistical procedures and analysis. This increased participation contributes to more meaningful and sustained learning. From the analysis of the score distribution, it is clear that the maximum score obtained by students was 89, while the minimum score was 31, with a mode of 77 and a median of 70.50. The mean score of 67.78 and standard deviation of 15.1210838 indicate significant variation in student scores. This variation indicates significant differences in students' levels of procedural understanding, reflecting the challenge of achieving equitable understanding among all students.

A high standard deviation indicates that some groups of students have excellent understanding and others still need to improve their understanding. Research by (Zimmerman & Kitsantas, 2002) suggests that the use of interactive multimedia, such as screencasts, can help reduce variation in understanding by providing materials that are accessible to students of all ability levels. This is important to ensure that all students have an equal opportunity to achieve in-depth understanding. Screencasts also provide easy access to learning materials, allowing students to study anytime and anywhere according to their needs. With screencasts, students can access structured and detailed explanations of complex statistical procedures, strengthening their understanding independently.

Procedural understanding gained through screencasts encompasses not only the ability to follow specific steps but also the logic and rationale behind each step. By viewing visual demonstrations, students can gain deeper insight into how and why a statistical procedure is applied in a given context. Thus, screencasts help develop analytical and problem-solving skills essential to procedural understanding (Mayer, 2009). These findings overall confirm that screencasts are a highly effective learning tool in enhancing students' procedural understanding in statistics education.

4. Conclusion

In conclusion, students' procedural understanding of Educational Statistics material can be effectively measured through a screencast project, as evidenced by the high percentage of correct answers to questions testing their procedural understanding. These results indicate that screencasts are an effective method for improving procedural understanding in the context of statistics education. This technology integration provides students with opportunities for independent learning, increases their engagement in the learning process, and deepens their understanding.

their understanding of the material being taught. These results are consistent with previous findings showing that multimedia, including screencasts, has great potential in educational contexts, especially in complex subjects such as statistics.

For future research, it is recommended to delve deeper into specific aspects related to the use of screencasts in educational statistics learning. For example, more focused research could be conducted on comparing the effectiveness of screencasts with other learning methods, exploring the use of screencasts in statistics learning contexts at different educational levels, or conducting a more in-depth analysis of the factors influencing the effectiveness of screencasts in improving student understanding. Thus, future research could provide deeper insights into the potential of screencasts as an effective learning tool in educational statistics contexts.

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