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Optimizing statistics education: Analyzing students' perceptions of SPSS usage

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Abstract

The integration of statistical software such as SPSS in higher education represents a pivotal advancement, yet limited research has systematically examined how students perceive its pedagogical usefulness and accessibility. Prior studies seldom differentiate between the cognitive and affective dimensions influencing the efficacy of SPSS-assisted learning, leaving a gap in understanding its broader impact on student engagement and competence. Addressing this gap, the present research investigates the novelty of SPSS implementation within statistics coursework, focusing specifically on student perceptions regarding its usefulness and ease of use. Employing a descriptive mixed-methods approach, quantitative data were collected from 85 respondents through a validated and reliable questionnaire comprising 13 items, complemented by qualitative insights from in-depth interviews using open-ended prompts. The findings indicate that student perceptions are predominantly favorable for both usefulness (79.21%) and ease of use (75.18%). Qualitative analysis substantiates these results, highlighting accelerated data analysis, simplified processing, and enhanced visualization as key strengths, while noting initial challenges faced by some participants. The study underscores that optimizing the educational value of SPSS necessitates comprehensive instructional support, thereby informing future curricular improvements designed to foster numeracy and analytical proficiency in statistical learning.

Keywords: Mixed-methods Approach, Perceptions, SPSS, Statistics Education

Introduction

Statistics, as a fundamental branch of applied mathematics, encompasses scientific methods for collecting, organizing, summarizing, presenting, and analyzing data to draw valid

conclusions and make informed decisions (Spiegel et al., 1996). It serves as a universal language of evidence across various disciplines, providing a methodological foundation for understanding phenomena and communicating findings effectively (Healey, 2015). In essence, statistics functions as a systematic process for transforming data into meaningful insights, enabling researchers and practitioners to substantiate claims with empirical rigor.

In the current data-driven era, the role of statistics has become increasingly pivotal across domains such as natural sciences, social sciences, engineering, and health sciences (Burrill & Pfannkuch, 2024). Statistical reasoning enables evidence-based decision making (Jaya, 2010; Musna, 2022), the testing of hypotheses (Rudini, 2016), and the validation of theories (Azizah & Nugraha, 2021). In social sciences, statistics guide researchers in identifying the strength and direction of relationships between variables, thus ensuring the reliability and validity of findings. Moreover, statistical data serve as critical resources for policymaking and societal development; demographic, economic, and educational data guide the formulation of policies that aim to enhance public welfare (Rahmah, 2023). In industrial contexts, statistics contribute to process optimization (Tsoraya, 2017) and resource management (Ansory & Indrasari, 2018) through tools such as statistical quality control (SQC). Business enterprises employ statistical analysis to identify market trends (Prabowo et al., 2023; Sugiana & Musty, 2023) and analyze consumer behavior (Mustafa et al., 2024). In health sciences, statistics support epidemiological research and clinical trials by elucidating disease patterns and evaluating treatment effectiveness (Arraniri et al., 2024). Similarly, in technology and engineering, statistical analysis underpins research and development processes (Rudini, 2016), guiding system evaluation, problem diagnosis, and innovation. Recent progress in data analytics has also reinforced the role of statistics in artificial intelligence (AI) and machine learning (Pratama et al., 2023), where statistical models form the core of predictive algorithms.

Given its ubiquity and cross-disciplinary relevance, statistical literacy is an essential competence for students across higher education (Iskandar et al., 2024; Cipta et al., 2024). The ability to interpret, analyze, and communicate data effectively prepares students to navigate the complexities of an increasingly data-rich society (Sestir et al., 2023; Lau & Tasir, 2024; Burrill & Pfannkuch, 2024; Cipta, Suryadi, Herman, Jupri, et al., 2024). As technology continues to transform educational practices (Navarro et al., 2023; Cipta et al., 2023), the integration of digital tools has redefined statistical learning into a more interactive and contextualized experience (Barros et al., 2023; Tilari et al., 2024). One of the most prominent tools supporting this transformation is the Statistical Package for the Social Sciences (SPSS), widely recognized for its capacity to bridge theoretical and applied aspects of statistical learning (Morgan et al., 2004). SPSS offers an extensive array of analytical functions ranging from descriptive to multivariate analysis (Priyastama, 2020), thereby facilitating meaningful engagement with real-world data.

The use of SPSS in educational settings provides multiple pedagogical advantages. First, it allows students to apply theoretical concepts through hands-on data analysis, thereby reinforcing conceptual understanding. Second, its intuitive interface reduces technical barriers, enabling students to focus on the interpretation of results rather than computational procedures.

Third, SPSS enhances efficiency and analytical accuracy, fostering professional readiness by developing data-driven competencies relevant to the workplace. Finally, its visualization tools promote clarity in representing complex statistical outcomes, improving students' ability to communicate results effectively (Kusumah & Perdana, 2018; Sitopu et al., 2021). These features contribute to better comprehension, motivated learning, and the development of transferable analytical skills (Suryati & Krisna, 2023).

Despite the recognized pedagogical benefits of SPSS, research exploring students' perceptions toward its usefulness and ease of use remains limited. Understanding such perceptions is critical since positive attitudes toward technology-based learning tools are associated with improved engagement and learning outcomes (Olivarría et al., 2022; Saidi et al., 2022). Moreover, perceptions influence how students construct meaning from technological experiences and how effectively they develop statistical literacy (Mireia et al., 2024). Therefore, examining the views of pre-service teachers toward SPSS integration in statistics education presents both theoretical and practical significance. It provides insights that can inform curriculum design and instructional strategies aligned with 21st-century learning competencies.

This study aims to analyze student teachers' perceptions of the use of SPSS in statistics learning, focusing on the dimensions of perceived usefulness and ease of use, and exploring the underlying reasons behind these perceptions. The novelty of this research lies in its combined quantitative and qualitative approach to investigating perceptions across multiple study programs within a computer-laboratory context an area previously underexplored in the literature (Masood & Lodhi, 2016; Kusumah & Perdana, 2018; Ishak et al., 2018; Murana & Rahimin, 2021; Suryati & Krisna, 2023). By addressing this gap, the study seeks to contribute to the development of adaptive, technology-oriented pedagogical frameworks in statistics education. The findings are expected to provide empirical evidence for designing more effective, contextual, and professionally relevant learning strategies that enhance students' readiness to meet the demands of the digital and data-driven workforce.

Methods

This study employed a descriptive research design integrating both quantitative and qualitative approaches to obtain a comprehensive depiction of students' perceptions in statistics learning using SPSS (Creswell, 2016). The quantitative component measured students' overall perceptions based on two key indicators usefulness and ease of use while the qualitative component explored the underlying reasons for these perceptions through in-depth interviews. This mixed approach enabled the triangulation of data, thereby strengthening the validity and interpretive depth of the findings.

The research was conducted across three study programs: Mathematics Education, Elementary School Teacher Education, and Islamic Religious Education. The study population comprised students enrolled in Statistics courses employing SPSS practice during the even semester of the 2023/2024 academic year. A total of 85 students were purposively selected based on their active participation in SPSS-based learning activities, ensuring that the sample represented informed and experienced participants.

Instruments

Two instruments were utilized: a structured questionnaire and an interview guide. The questionnaire adopted a four-point Likert scale consisting of Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). It comprised 13 items developed under two major indicators perceived usefulness and perceived ease of use adapted from Savira Nurfathi (2019) and constructed following the principles of instrument development outlined by Riduwan (2007). The interview guide contained open-ended questions designed to elicit deeper explanations of respondents' attitudes and experiences related to SPSS usage.

Prior to data collection, the questionnaire was pilot-tested to ensure validity and reliability. Validity was assessed using Pearson's Product-Moment correlation, while internal consistency reliability was verified through Cronbach's Alpha coefficient. The results demonstrated that all items satisfied both validity and reliability criteria, confirming the instrument's suitability for data collection.

Data Analysis Procedures

The data analysis followed five systematic stages: (1) data coding, (2) data entry, (3) data cleaning, (4) data output, and (5) data analysis.

1. Data Coding - Responses from the questionnaire were coded numerically according to the scoring criteria shown in Table 1 to facilitate quantification and interpretation.

Table 1. Likert Scale Scoring Criteria

Response Category	Score
Strongly Agree	4
Agree	3
Disagree	2
Strongly Disagree	1

2. Data Entering - All coded responses were systematically entered into Microsoft Excel to organize and prepare them for subsequent analysis.
3. Data Cleaning - During this phase, the dataset was reviewed to ensure accuracy and completeness, including checking for duplicate entries, outliers, or illogical responses.
4. Data Output - Processed data were summarized in terms of frequency distributions and percentages, calculated using the following formula:

$$P = \frac{SR}{SM} \times 100$$

Note:

$$\mathrm{P} = \text{Percentage Value}$$
$$\mathrm{SR} = \text{Respondent Score}$$
$$\mathrm{SM} = \text{Maximum Score}$$

5. Data Analysis - Quantitative data were analyzed descriptively by computing the mean and percentage for each indicator of perception, which were then interpreted according to the criteria in Table 2. Meanwhile, qualitative data obtained from interviews were analyzed

using thematic analysis to identify recurring themes that provided contextual explanations for the quantitative findings. The integration of both datasets produced a consolidated interpretation that reflected students' cognitive and affective perspectives on the use of SPSS in statistics learning.

Table 2. Percentage Scale Scoring Criteria

Percentage	Criteria
$80 < x \leq 100$	Excellent
$60 < x \leq 80$	Good
$40 < x \leq 60$	Enough
$20 < x \leq 40$	Less
$0 \leq x \leq 20$	Very Less

Results and Discussion

Data on students' perceptions of learning statistics using SPSS were collected through a questionnaire comprising 13 items distributed across two measured constructs: perceived usefulness and perceived ease of use. Each construct was operationalized through five descriptive indicators designed to capture the multidimensional nature of student perceptions. The indicators for the perceived usefulness construct included: (1) tasks are completed more efficiently using the application, (2) productivity increases through its use, (3) the application enhances work effectiveness, (4) SPSS provides tangible benefits in data analysis, and (5) the application simplifies statistical tasks. The indicators for the perceived ease of use construct consisted of: (1) the application is easy to learn, (2) it is simple to operate, (3) its interface facilitates clear and effective interaction, (4) it offers flexibility in use, and (5) it supports skill development through practical engagement. Table 3 presents the empirical data derived from the field study, organized according to these indicators.

Table 3. Student Perceptions Based on Utility Indicators

No	Indicators	Average	Category
1	Faster work completed	83,82	Excellent
2	Increased productivity	80,15	Excellent
3	Increased work effectiveness	77,65	Good
4	Apps can provide benefits	76,76	Good
5	Easier work	77,65	Good
	Total Average	**79,21**	**Good**

Based on the results presented in Table 3, the mean score for all indicators of the perceived usefulness variable was 79.21 percent. This indicates that among 85 respondents, 68 students perceived the use of SPSS in statistics learning as beneficial, placing their responses

within the good category. The indicator showing that SPSS enables tasks to be completed more rapidly obtained the highest average score of 83.82 percent, categorized as very good. In contrast, the indicator stating that SPSS provides practical benefits registered the lowest mean value of 76.76 percent, corresponding to the good category, with approximately 65 students selecting this response. Despite being the lowest, the latter value still demonstrates that the vast majority of students recognized the positive contributions of SPSS to the learning process.

The quantitative findings were complemented by qualitative data obtained through semi-structured interviews. These interviews explored the rationale behind the students' responses and revealed nuanced perspectives regarding SPSS usage. Students with highly positive perceptions emphasized that SPSS substantially simplified data analysis, reduced time requirements, and enhanced their conceptual understanding of statistical material previously perceived as challenging. One respondent noted that using SPSS allowed immediate access to analysis results, minimizing the risk of computational error. Students expressing moderate perceptions acknowledged that while SPSS was advantageous, correct interpretation of output still required a solid grasp of statistical theory. Meanwhile, a smaller number of respondents indicated that the initial learning stage posed difficulties and required additional instructional support. Collectively, these qualitative insights reinforced the survey results, signifying that SPSS exerted a generally positive effect on students' learning experiences, albeit with varying degrees of adaptation.

These findings are consistent with prior research indicating that the integration of statistical software into instruction enhances students' conceptual comprehension (Sitopu et al., 2021) and analytical competencies (Ghazali et al., 2023). Accordingly, the utilization of SPSS not only accelerates task completion but also elevates the overall quality and depth of statistics learning (Selwyn, 2011). Following the analysis of the usefulness dimension, the subsequent section examines the perceived ease of use variable, summarized in Table 4, which presents the responses of 85 participants across five indicators.

Table 4. Student Perceptions Based on Ease Indicators

No	Indicators	Average	Category
1	Learn easily	68,53	Good
2	Easily controlled	75,88	Good
3	Interact with ease	79,12	Good
4	Flexibility in interacting	78,53	Good
5	Skilled in using the app	73,82	Good
	Total Average	**75,18**	**Good**

Based on the data presented in Table 4, the indicator representing ease of interaction received the highest mean percentage within the perceived ease of use variable, scoring 79.12 percent, which falls into the good category. Conversely, the indicator referring to ease of learning recorded the lowest percentage, 68.53 percent, which likewise remains within the good category. Overall, the variable of perceived ease of use obtained an average value of 75.18 percent, also categorized as good. This result indicates that approximately 64 of the 85

respondents agreed that the SPSS application facilitates a smoother and more accessible learning experience in statistics, demonstrating general student consensus regarding the tool's usability.

Further elaboration through student interviews provided deeper insights into these perceptions. The majority of students described SPSS as intuitive and easy to navigate, attributing this to its user-friendly interface and the extensive availability of online resources and tutorials. One participant commented that SPSS's automated features and guided options significantly streamlined the analytical process, allowing her to concentrate on interpreting data rather than managing operational procedures.

Nevertheless, several students reported initial difficulties when first engaging with the software, particularly those with limited technical exposure. Although they acknowledged the eventual advantages of SPSS for data management and computation, they emphasized that mastering its functions required focused effort and sustained practice. Many respondents highlighted that instructional support played a key role in mitigating these challenges. Guidance from lecturers, supplemented by structured teaching materials and contextualized practice using real datasets, was identified as instrumental in accelerating familiarity with SPSS.

The integration of quantitative and qualitative findings thus suggests that, despite early learning challenges, students consistently recognized the practicality and accessibility of SPSS in statistical learning. Positive perceptions of interactive ease indicate that, when combined with targeted instructional assistance, SPSS serves as an effective pedagogical instrument for developing statistical reasoning and applied data analysis skills. These findings align with previous research demonstrating that SPSS enhances both learning efficiency and comprehension (Brezavšček et al., 2014; Kusumah & Perdana, 2018; Nurhayati & Novianti, 2020). Moreover, the evidence supports the proposition that SPSS should be systematically integrated into the curriculum to strengthen students' analytical proficiency and digital competency in mathematics education (Hasen et al., 2022).

Conclusion

The results of this study demonstrate that students' perceptions of the use of SPSS in statistics learning fall within the good category for both dimensions examined: perceived usefulness (79.21 percent) and perceived ease of use (75.18 percent). The quantitative findings were substantiated by qualitative data, which revealed that students viewed SPSS as a practical and effective tool for accelerating statistical analysis, simplifying data processing, and presenting information in a more interpretable and visual form. Although several participants encountered challenges during the initial stages of learning, structured guidance and adequate instructional support were shown to mitigate these difficulties. These results affirm that the systematic integration of SPSS into statistics education offers substantial pedagogical benefits by promoting conceptual understanding and enhancing students' analytical accuracy and computational confidence.

On the other hand, this study was limited by sample scope and contextual specificity, involving a single institutional cohort and focusing primarily on descriptive analysis within

three study programs. Consequently, the findings may not fully capture variations in perceptions across broader educational settings or different levels of statistical proficiency. Future research is recommended to employ comparative or experimental designs across multiple institutions, incorporating diverse statistical software and larger sample populations to generalize results more robustly. Additionally, longitudinal studies examining changes in perception and performance over time would provide valuable insights into the sustained impact of SPSS-assisted learning. Pedagogically, this research highlights the need for educators and curriculum developers to integrate SPSS into mathematics and statistics education through a scaffolded instruction model that combines theory, practice, and reflection, thereby equipping students with the computational literacy and critical reasoning skills essential for the data-driven academic and professional environments of the twenty-first century.

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