

Research Article

Enhancing statistical literacy and decision-making skills among nigerian university students

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Abstract

This study examined the role of statistical literacy in enhancing decision-making skills among the Nigeria university students in higher education. Specifically, the study determined the level of statistical literacy among students, investigated its influence on decision-making skills, and explored its relationship with students' ability to interpret and use data. A descriptive survey research design was adopted, and a sample of 159 undergraduate students was drawn from three universities in Nigeria. Data were collected using a structured questionnaire titled Statistical Literacy and Decision-Making Skills Questionnaire (SLDMSQ) and analyzed using descriptive and inferential statistical methods. The findings revealed that a majority of students (71%) demonstrated a high level of statistical literacy, while 29% showed low competence. The results further indicated that statistical literacy positively influenced students' decision-making skills, with an average of 69% of students demonstrating improved decision-making across the institutions. Additionally, a strong positive relationship was found between statistical literacy and students' ability to interpret and use data effectively. The study concluded that statistical literacy is a critical factor in promoting data-driven decision-making and recommended the integration of practical, data-based teaching approaches in higher education.

Keywords: Statistical literacy, decision-making, data interpretation, higher education, university students

1. Introduction

In the contemporary knowledge-driven society, the ability to understand and interpret statistical information has become an essential skill for university students. Modern societies generate vast amounts of data through research, government activities, business operations, and digital technologies.

As a result, individuals are constantly required to interpret statistical information in order to make informed decisions in academic, professional, and everyday contexts. Within higher education is a fundamental competence that enables students to critically evaluate information, interpret quantitative evidence, and apply data in problem-solving situations.

"Statistical literacy" refers to the ability to understand, interpret, critically evaluate, and communicate statistical information and data-based arguments (Koga, 2022). Characteristics of statistical literacy skills from the

perspective of critical thinking. It involves skills such as reading graphs and tables, understanding statistical concepts, interpreting research findings, and making reasonable conclusions based on data (Pudjiastuti, 2022). University students are frequently exposed to statistical information through coursework, research activities, policy discussions, and media reports. Without adequate statistical literacy, students may struggle to interpret data correctly, which may lead to poor judgment and weak decision-making (Allen *et al.*, 2016). Difficult decisions: a qualitative exploration of the statistical decision-making process from the perspectives of psychology students and academics. In recent years, higher education institutions have increasingly emphasized the importance of data-driven decision-making (Elugbaju *et al.* 2024). Conceptual framework for enhancing decision-making in higher education through data-driven governance.

Many disciplines such as education, economics,

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business, health sciences, and social sciences rely heavily on statistical evidence for planning, evaluation, and policy formulation. Consequently, students are expected not only to perform statistical calculations but also to develop the ability to interpret and apply statistical results meaningfully (Hinton 2024). The development of statistical literacy equips students with the intellectual tools required to analyze data, evaluate arguments supported by statistics, and make rational decisions based on evidence.

Despite the growing importance of statistical literacy, many university students still experience difficulties in understanding and applying statistical concepts. Previous studies have indicated that students often focus on procedural aspects of statistics, such as formula memorization and computation, rather than conceptual understanding and interpretation of results. This situation limits their ability to translate statistical knowledge into practical decision-making skills. As a result, students may be able to perform calculations but still lack the ability to critically interpret statistical findings or use them effectively in real-life situations (Van Borkulo *et al*, 2023). Using Real-Life Data When Teaching Statistics: Students' Perceptions of This Strategy in an Introductory Statistics Course.

However, this challenge is related to the traditional methods used in teaching statistics in many higher education institutions. Statistics is often taught in a theoretical and abstract manner, which may discourage students and reduce their interest in the subject. When statistical concepts are not connected to real-life data and practical applications, students may fail to appreciate the relevance of statistics to everyday decision-making. Integrating real-life datasets, practical examples, and data-driven learning approaches can help bridge this gap and improve students' understanding and application of statistical concepts (Cujba & Pifarré, 2024). Enhancing students' attitudes towards statistics through innovative technology-enhanced, collaborative, and data-driven project-based learning. Developing strong statistical literacy among university students is particularly important because they are future professionals, policymakers, educators, and researchers who will make decisions that affect society. Informed decision-making requires the ability to interpret data correctly, evaluate statistical evidence critically, and avoid common misconceptions associated with data interpretation. Students who possess strong statistical literacy skills are more likely to make logical decisions, evaluate competing claims, and contribute meaningfully to evidence-based discussions in their respective fields. (Berndt *et al*, 2021). Developing students' statistical reasoning: Connecting research and teaching practice.

Furthermore, statistical literacy supports the development of critical thinking and analytical reasoning skills. When students engage with data, interpret statistical results, and evaluate evidence, they learn to question

assumptions, identify patterns, and draw informed conclusions. These abilities are essential for academic research and professional practice in the twenty-first century. Therefore, improving statistical literacy in higher education has the potential to enhance students' analytical competence and strengthen their capacity for effective decision-making (Berndt *et al.*, 2021).

Although the importance of statistical literacy has been widely recognized, there is still a need to examine the extent to which university students possess these skills and how such skills influence their decision-making abilities. Understanding the relationship between statistical literacy and decision-making can provide valuable insights for educators, curriculum designers, and policymakers who aim to improve statistics education in higher institutions. Empirical evidence on students' statistical literacy levels and their ability to interpret and use data can also guide the development of more effective teaching strategies. (Friedrich *et al*, 2024). Against this background, this study seeks to examine how statistical literacy can enhance students' decision-making skills in higher education. Specifically, the study focuses on determining the level of statistical literacy among university students, examining the influence of statistical literacy on students' decision-making skills, and investigating the relationship between statistical literacy and students' ability to interpret and use data. The findings of this study are expected to contribute to the improvement of statistics education and promote the development of data-informed decision-making skills among university students. (Brazauskienė, 2025).

Statistical literacy has become an important component of education in the modern data-driven world (François *et al.*, 2020). With the increasing availability of quantitative information in different sectors such as education, health, economics, and social sciences, individuals are expected to possess the ability to interpret and critically evaluate statistical data (Gordon, 2023). In higher education, statistical literacy plays a significant role in enabling students to understand research findings, analyze data, and make informed decisions based on evidence (Huang *et al.*, 2025).

Statistical literacy is commonly defined as the ability to understand, interpret, critically evaluate, and communicate statistical information and messages (Koga, 2022). Scholars describe statistical literacy as a combination of knowledge of statistical concepts, the ability to interpret data representations such as graphs and tables, and the capacity to evaluate statistical arguments presented in everyday life. It also involves understanding variability, uncertainty, probability, and the context in which statistical information is presented. Students who possess statistical literacy are able to make meaningful interpretations of data and apply statistical reasoning to solve problems (Selvakumar *et al.*, 2025).

Several studies have emphasized that statistical literacy

is essential for effective decision-making. Decision-making in academic and professional settings often requires individuals to analyze data, evaluate evidence, and select the most appropriate course of action based on available information (Parnell et al., 2025). When students are statistically literate, they are better equipped to interpret data trends, understand statistical results, and use quantitative evidence to support their decisions. Consequently, statistical literacy is closely linked with the development of critical thinking and analytical reasoning skills among university students (Koga, 2022). Researchers have also noted that statistical literacy goes beyond the ability to perform statistical calculations (Batur & Baki, 2022). While computational skills remain important, statistical literacy focuses more on conceptual understanding and interpretation of results. Students should be able to explain statistical findings, recognize misleading data presentations, and evaluate the credibility of statistical information (Engledowl & Weiland, 2021). This broader understanding enables students to apply statistical knowledge in real-life contexts rather than limiting their learning to theoretical classroom exercises (Biehler et al., 2018).

In higher education, the teaching of statistics is often designed to equip students with both technical and interpretative skills. However, studies have shown that many students experience difficulties when learning statistics (Estrada et al., 2015). Statistics anxiety, negative attitudes toward mathematics, and the abstract nature of statistical concepts can hinder students' understanding (Peiró-Signes et al., 2021). When students struggle to connect statistical theories with practical applications, their ability to interpret data and make decisions based on statistical evidence becomes limited (Peiró-Signes et al., 2021).

Another important aspect discussed in the literature is the role of real-life data in improving statistical literacy (Aziz et al., 2021). When instructors incorporate real-world datasets into statistics teaching, students are more likely to understand the relevance of statistical concepts to everyday life (Neumann, 2013). Working with real-life data allows students to practice interpreting information, identifying patterns, and drawing conclusions from evidence (Robson, 2024). Such approaches help bridge the gap between theoretical knowledge and practical application, thereby strengthening students' statistical reasoning and decision-making skills (Hasim et al., 2024).

Studies have also highlighted the relationship between statistical literacy and students' ability to interpret data (Batur & Baki, 2022). Data interpretation involves reading charts, graphs, and tables, understanding relationships between variables, and drawing logical conclusions from numerical information (Alem, 2020). Students with higher levels of statistical literacy are generally more capable of identifying patterns in data, evaluating statistical arguments, and making valid interpretations (Watson, 2013). This ability

is particularly important in academic research, where students must analyze data and present evidence-based conclusions (Florin et al., 2012).

Furthermore, statistical literacy contributes significantly to research competence among university students (Zhang & Han, 2024). Many academic programs require students to conduct research projects that involve data collection, analysis, and interpretation (Winchester & Freeman, 2020). Without adequate statistical literacy, students may encounter difficulties in analyzing data accurately or explaining the meaning of their findings (Sutherland et al., 2024). Consequently, improving students' statistical literacy can enhance the quality of research conducted in higher education institutions (Lukman et al., 2022).

Despite the recognized importance of statistical literacy, several studies report that many university students still demonstrate relatively low levels of statistical understanding (Gal, 2019). Students may correctly perform calculations but struggle to interpret statistical outputs or apply them in decision-making contexts (Vanlommel & Schildkamp, 2019). This situation suggests the need for improved teaching strategies that emphasize conceptual understanding, real-life applications, and critical interpretation of data (Vanlommel & Schildkamp, 2019).

In response to these challenges, educators and researchers have advocated for the adoption of data-driven teaching approaches in statistics education. These approaches focus on engaging students with real datasets, encouraging exploration of data, and promoting active learning through problem-solving activities (Tsai, 2024). Such instructional strategies aim to develop students' ability to think statistically, interpret quantitative information, and make informed decisions based on evidence (Hasim et al., 2024).

Based on the existing literature, it is evident that statistical literacy plays a crucial role in enhancing students' decision-making skills and their ability to interpret and use data effectively (Friedrich et al., 2024). However, there remains a need for further empirical investigation into the level of statistical literacy among university students and how it influences their decision-making abilities (Berndt et al., 2021). This study therefore seeks to contribute to the existing body of knowledge by examining the level of statistical literacy among university students and exploring its relationship with students' ability to interpret data and make informed decisions in higher education.

In today's data-driven world, university students are expected to understand and use statistical information for informed decision-making; however, many still struggle with interpreting and applying statistical concepts effectively. This challenge is often due to teaching approaches that focus more on calculations than on real-life understanding and application. As a result, students may perform statistical procedures correctly but lack the ability to interpret data or

make sound decisions based on evidence. This gap raises concerns about their academic performance and future professional competence. Few Nigerian studies have empirically examined how statistical literacy predicts university students' data-driven decision-making abilities across institutions. Therefore, this study examined students' level of statistical literacy, its influence on their decision-making, and its relationship with their ability to interpret and use data.

The aim of this study is to examine how statistical literacy can enhance students' decision-making skills in higher education with the corresponding objectives:

- (i) To determine the level of statistical literacy among university students.
 - (ii) To examine the influence of statistical literacy on students' decision-making skills.
 - (iii) To investigate the relationship between statistical literacy and students' ability to interpret and use data.
1. What is the level of statistical literacy among university students?
 2. How does statistical literacy influence students' decision-making skills in higher education?
 3. What is the relationship between statistical literacy and students' ability to interpret and use data for decision-making?

The following are the hypotheses of this research:

- H₀₁: There is no significant relationship between statistical literacy and students' decision-making skills.
- H₀₂: Statistical literacy does not significantly influence students' ability to interpret data.
- H₀₃: There is no significant difference in decision-making skills among students with different levels of statistical literacy.

2. Methodology

The study adopted a descriptive survey research design. The descriptive survey design was considered appropriate because it enabled the researcher to collect data from a group of respondents in order to describe existing conditions and examine relationships among variables. The design was suitable for this study as it sought to determine the level of statistical literacy among university students and examine its influence on their decision-making skills and ability to interpret data.

The study was conducted in three universities located in different states of Nigeria: Federal University of Technology, Minna, in Niger State; Federal University of Lagos in Lagos State; and Federal University of Technology, Owerri, in Imo State.

These federal institutions were selected to provide a diverse representation of students across different geographical and academic environments in different geopolitical zones.

The population of the study consisted of undergraduate students of mathematics, statistics, and mathematics education in the 3 universities. These students were considered appropriate because they were exposed to statistical concepts through their academic programs and were expected to apply statistical knowledge in their studies and research activities.

A sample of 159 undergraduate students was selected from the large number more than 500 population for the study. The sample was drawn using simple random sampling technique. This method helped to reduce sampling bias and ensured that the sample adequately represented the population.

The main instrument used for data collection was a structured questionnaire titled Statistical Literacy and Decision-Making Skills Questionnaire (SLDMSQ). The questionnaire consisted of two sections:

- Demographic information of respondents, such as gender, level of study, and department.
- Items designed to measure students' statistical literacy, decision-making skills, and ability to interpret and use data.

The items in Section B were structured on a four-point Likert scale of Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD).

The instrument was subjected to face and content validity by experts in mathematics education and educational research. Their suggestions and corrections were incorporated to ensure that the questionnaire adequately measured statistical literacy and decision-making skills among the students.

The reliability of the instrument was determined through a pilot study conducted with a small group of undergraduate students who were not part of the main study. The data obtained from the pilot test were analyzed using Cronbach's alpha reliability method of 0.82 was used to determine the internal consistency of the instrument.

The researcher administered the questionnaires directly to the selected students in their respective departments across the three universities. The purpose of the study was clearly explained to the respondents, and they were assured that the information provided would be used strictly for academic purposes. The completed questionnaires were collected immediately after completion.

3. Results

3.1. Results of Research Question One

Research Question 1; *What is the level of statistical literacy among university students?*

Table 1 indicates that a majority (71%) of the students demonstrated a high level of statistical literacy, as reflected in their ability to make informed decisions. However, 29% of the respondents exhibited low statistical literacy, suggesting that a notable proportion of students still lack adequate

statistical competence.

Table 1: Level of Statistical Literacy (Proxy: Ability to Make Informed Decisions)

Response Category	Frequency	Percentage (%)
High (Yes)	113	71%
Low (No)	46	29%
Total	159	100%

3.2. Results of Research Question Two

Research Question 2: *How does statistical literacy influence students' decision-making skills in higher education?*

Table 2 shows that statistical literacy positively

influenced students' decision-making skills across all locations. Futminna recorded the highest influence (79%), followed by Futowerri (71%), while Unilag had the lowest (56%). On average, 69% of students demonstrated improved decision-making skills due to statistical literacy, confirming its significant role in higher

Table 2: Influence of Statistical Literacy on Decision-Making by Location

Location	Yes (%)	No (%)	Total (%)
FUTOWERRI	71%	29%	100%
FUTMINNA	79%	21%	100%
UNILAG	56%	44%	100%
AVERAGE	69%	31%	100%

3.3. Results of Research Question Three

Research Question 3 : *What is the relationship between statistical literacy and students' ability to interpret and use data for decision-making?*

Table 3 reveals a strong positive relationship between statistical literacy and students' ability to interpret and use

data. A higher proportion (69%) of students who demonstrated statistical literacy were also able to effectively interpret and apply data in decision-making. This suggests that statistical literacy is a key determinant of data-driven decision-making competence among university students

Table 3: relationship between statistical literacy and students' ability to interpret and use data

Indicator	Frequency	Percentage (%)
Students with Statistical Literacy (Yes)	111	69%
Students with Limited Statistical Literacy (No)	49	31%
Total	159	100%

4. Discussion

The findings of this study revealed that although a majority of university students demonstrated a relatively high level of statistical literacy (71%), a significant proportion (29%) still lacked adequate competence. The study further showed that statistical literacy had a strong positive influence on students' decision-making skills, as reflected in the majority of students (69%) who were able to make informed decisions across the selected universities, although variations existed among institutions.

In addition, the results established a clear positive relationship between statistical literacy and students' ability to interpret and use data effectively, confirming that students with higher statistical literacy were better equipped to analyze, understand, and apply data in decision-making contexts. These findings align with existing literature, which

emphasizes that statistical literacy extends beyond computational ability to include interpretation, critical thinking, and real-life application of data. Overall, the results highlight the central role of statistical literacy in fostering analytical reasoning, improving academic performance, and enhancing students' capacity for evidence-based decision-making in higher education.

5. Conclusion

This study examined the level of statistical literacy among three universities, students and its influence on their decision-making skills and ability to interpret and use data in higher education. The findings revealed that a majority of students demonstrated a relatively high level of statistical literacy; however, a considerable proportion still exhibited limited competence in understanding and applying statistical information. The study further established that statistical literacy significantly enhances students' decision-making

skills, as students with higher statistical literacy were more capable of making informed and rational decisions. In addition, a strong positive relationship was found between statistical literacy and students' ability to interpret and use data effectively. These findings underscore the critical role of statistical literacy in fostering data-driven thinking, analytical reasoning, and evidence-based decision-making among university students. Therefore, improving statistical literacy should be considered a key priority in higher education, particularly in preparing students for academic success and professional practice in a data-driven world.

Recommendations

Based on the findings of this study, the following recommendations were made:

1. Curriculum Improvement:
Universities should redesign statistics curricula to emphasize conceptual understanding, data interpretation, and real-life applications rather than focusing solely on computational procedures.
2. Adoption of Data-Driven Teaching Approaches:
Lecturers should incorporate real-life datasets, case studies, and practical problem-solving activities into statistics instruction to enhance students' engagement and understanding.
3. Capacity Building for Lecturers:
Institutions should organize regular training, workshops, and seminars for lecturers to equip them with modern, student-centered teaching strategies in statistics education.
4. Integration Across Disciplines:
Statistical literacy should be integrated across different academic disciplines to ensure that students continuously apply statistical knowledge in diverse contexts.
5. Use of Technology and Digital Tools:
Educational technologies such as statistical software, simulations, and interactive learning platforms should be utilized to support the teaching and learning of statistics.
6. Early Exposure to Statistical Thinking:
Students should be introduced to statistical reasoning and data interpretation skills early in their academic programs to build a strong foundation.
7. Further Research:
Future studies should employ advanced statistical techniques (such as regression or structural equation modeling) to provide deeper insights into the relationship between statistical literacy and decision-making and should also explore larger and more diverse populations.

Abbreviations

SLDMSQ	Statistical Literacy and Decision-Making Skills Questionnaire
FUTOWERRI	Federal University of Technology Owerri
FUTMINNA	Federal University of Technology Minna

UNILAG University of Lagos

Author Contributions

Philip Tsado Issa: Conceptualization, Investigation, Validation, writing –Review & Editing, Project Administration, Methodology.

Ahmed Rufai Tete: Formal Analysis

Abubakar Aliyu: Writing- Review & Editing

Musa Jatau : Writing–Original Draft, Review & Editing

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Conflicts of Interest

The author(s) declare that they have no known competing financial interests, professional affiliations or personal relationships that could have appeared to influence the work reported in this paper.

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