

Significance Of Basic Statistics In Educational Research: Graduate Student Perspectives

Engr. Criselda S. Felix, PhD^a
Mary Ann P. Paculan^b
Irish D. Galuludan^b
Maribel Y. Galwak^b
Freda U. Alacdes^b

^a Faculty, Graduate School, Baguio Central University, Baguio City, Philippines 2600

^b Graduate School students, Baguio Central University, Baguio City, Philippines 2600

Abstract

This research study utilized a descriptive research design employing a questionnaire to investigate the perception and comprehension of basic statistics in educational research among graduate and post-graduate students at Baguio Central University. Developed with input from primary and secondary sources, the questionnaire was administered to 86 students enrolled in statistics and research courses during the first semester of School Year 2023-2024. Analysis of the data revealed a widespread recognition of the significant role of basic statistics in educational research, with respondents emphasizing its importance in various aspects including research conduct, method selection, decision-making, and outcome evaluation. Furthermore, statistics emerged as a vital tool in education, facilitating improvements in teaching methods, student progress monitoring, resource allocation, and policy impact assessment. However, notable gaps were identified, such as a lack of emphasis on practical application over theoretical understanding, challenges in selecting appropriate statistical tools, and insufficient integration of statistical skills into educational programs. Addressing these gaps is imperative to ensure that graduates possess the necessary statistical literacy for effective engagement in educational research and evidence-based decision-making in the field of education.

Keywords: Statistics; Educational research; Methodology; Statistical literacy; graduate school

1. Introduction

Statistics serves as a fundamental tool for researchers, enabling them to comprehend their data and draw statistical inferences applicable to broader populations. Through systematic processes of data collection, description, analysis, and interpretation, researchers derive meaningful conclusions crucial for addressing real-world challenges. The systematic nature of statistics allows for the rigorous consideration of variability and uncertainty, ensuring the validity of inferences drawn. In research, data emanates from diverse sources like surveys, experiments, and observational studies, gathered through various methods such as interviews and surveys. Regardless of the method employed, maintaining consistency in data collection and analysis is imperative to ensure the accuracy and reliability of results, highlighting the pivotal role of statistics (Pal, 2023).

Statistics, as a branch of mathematics, encompasses techniques for collecting, analyzing, and interpreting data, serving as the analytical backbone of scientific inquiry. It facilitates the proper collection of data, the employment of appropriate analyses, and the effective presentation of results, essential for making discoveries, decisions, and predictions in science (Snedecor and Cochran, 1980; Isotalo, 2006; Obiaraije, 2021). Moreover, statistics serves as a powerful tool for reviewing, analyzing, and drawing conclusions from data, playing a significant role in educational research

(McGraw-Taylor Harris, 2007).

In educational research, statistics aids in planning, designing, and executing research studies, as well as summarizing and exploring gathered data to make inferences and predictions (Lodiko, 2010; Yates, 2004). Its importance in education cannot be overstated, as it enables informed decision-making crucial for improving learning outcomes in today's data-driven world (Agarwal, 2021). By leveraging statistical analysis, educators and policymakers can identify areas for improvement, evaluate teaching methods, monitor student progress, optimize resource allocation, and assess policy impacts, underscoring the necessity for a strong foundation in statistics and data analysis (Pal, 2023).

There is a noticeable research gap regarding the practical application of statistics in educational research, despite widespread acknowledgment of its importance.

While existing literature predominantly focuses on the theoretical aspects of statistics, there is limited exploration of how this theoretical knowledge translates into practical skills for effective research conduct. For instance, studies could delve deeper into the disparity between theoretical education in statistics and its practical implementation within educational research contexts (Pal, 2023). Understanding this gap is critical for designing educational programs that adequately equip students with the practical statistical skills necessary for conducting rigorous research. Similarly, despite the recognition of statistics as a vital tool in educational research, there is insufficient understanding of the challenges students face in selecting appropriate statistical tools for data analysis (Obiaraije, 2021). While the importance of statistical analysis is acknowledged, there is a lack of research addressing the specific difficulties students encounter when deciding which statistical techniques to employ in their research projects. Investigating these challenges could illuminate common misconceptions or gaps in knowledge hindering students' ability to make informed decisions about statistical tool selection. Such insights could inform targeted interventions aimed at enhancing students' proficiency in choosing and applying statistical methods effectively. Furthermore, there appears to be a gap in the integration of statistical skills into educational programs, despite the recognized significance of statistics in educational research (Lodiko, 2010; Yates, 2004).

Given the significance of statistics in educational research, this study aims to assess the applicability of basic statistics in different stages of educational research, evaluate graduate and postgraduate students' knowledge of basic statistics, and identify challenges faced by these students in utilizing statistics in their research endeavors. By enhancing students' knowledge and skills in basic statistics, this research seeks to empower them to effectively utilize statistical tools in designing and conducting research studies, preparing academic papers, and applying statistical concepts in their professional practice.

2. Review of Related Literatures

The philosophical, theoretical, and conceptual framework of this study underscores the indispensable role of statistics in scientific research, encompassing pivotal processes such as planning, data collection, analysis, interpretation, and reporting of findings. Grounded in philosophies and theories, this framework delves into the foundational aspects shaping statistical practices and their implications for research.

Philosophically, statistics grapples with drawing accurate inferences from data while navigating complexities like causality and correlation. Understanding that correlation does not necessarily imply causation is crucial for researchers to draw sound conclusions. Additionally, the ethical dimensions within statistics underscore the broader

philosophical considerations inherent in research practices (Kalla, 2010).

The philosophy of statistics, as articulated by the Stanford Encyclopedia of Philosophy, delves into the foundations and interpretations of statistical methods, shaping the philosophical appraisal of scientific methodologies. Central to this discourse is the problem of induction, which addresses the justification of inferences extrapolated from data to predictions and general facts. Moreover, debates surround the interpretation of probabilities and the broader theoretical frameworks supporting statistical methods (Stanford Encyclopedia of Philosophy, 2014).

The philosophical underpinnings of statistics intertwine with theoretical statistics, elucidating goals, methods, and the interpretation of inferential outcomes. These discussions intersect with the philosophy of science and the philosophy of probability, exploring the nature and interpretation of probability, metaphysical chance, and the role of probability in statistical modeling (Helland, 2014).

In educational research, philosophical analysis centers on the empirical practice of educational research, critically examining research methodology and framing. Research philosophy, as delineated by Business Research Methodology, delves into assumptions, knowledge, and the nature of the study, shedding light on varied epistemological stances guiding research endeavors (Business Research Methodology, n.d.). Furthermore, theories pertinent to statistics bolster the conceptual framework, providing systematic frameworks for analyzing chance events and making optimal decisions under uncertainty. Probability theory offers a mathematical foundation for assessing the likelihood of events, while statistical decision theory guides optimal decision-making amidst uncertain outcomes. These theoretical underpinnings complement the descriptive, relational, and explanatory theories within research, facilitating a comprehensive understanding of phenomena and their causal mechanisms (Wikipedia Free Encyclopedia, n.d.; Ngulube, 2018; Davidof, 2019).

The significance of statistical knowledge in educational research cannot be overstated, as it forms the cornerstone of empirical and quantitative studies (Koul, 1984). However, a concerning gap exists in the treatment and understanding of statistics among educators and students. This paper explores the underlying causes of this issue and sheds light on common challenges encountered in the application of statistical tools in research reports. One key challenge revolves around the debate over the theory-practice balance in statistics education, where theoretical concepts often overshadow practical application (Naik, 2015). Consequently, students graduate with only a surface-level understanding of statistical methodologies, exacerbated by a shortage of qualified instructors at the master's level (Sansanwal, 2015).

Moreover, common pitfalls in research reports include the indiscriminate collection of excessive and irrelevant data, inadequate planning resulting in incomplete or unusable data sets, and the misuse of statistical techniques due to a lack of understanding (Sansanwal, 2015). Furthermore, issues such as inappropriate sampling methods, failure to justify statistical tool selection, and misinterpretation of results contribute to the degradation of research quality (Buch, 1991). Addressing these challenges requires a concerted effort to prioritize statistical education at all levels, from undergraduate to postgraduate studies. By fostering a deeper understanding of statistical methods among educators and students alike, the quality and rigor of educational research can be significantly enhanced (Naik, 2015).

In sum, the amalgamation of philosophical reflections and theoretical constructs forms the robust framework

underpinning this study, guiding the rigorous exploration of statistical methodologies and their implications for scientific inquiry. While studies underscore the importance of statistical knowledge, there is limited research exploring the extent to which educational programs adequately equip students with the necessary statistical competencies. Investigating the integration of statistical concepts into curricula and the effectiveness of teaching methodologies in imparting these skills could provide valuable insights into areas for improvement. Addressing these gaps is essential to ensure that graduates possess the statistical literacy required to engage meaningfully in educational research and contribute effectively to evidence-based decision-making in the field of education.

On another note, educational research entails the systematic collection and analysis of data related to education, covering various aspects such as student learning, teaching methods, and classroom dynamics. Statistics plays a crucial role in this process, aiding researchers in planning, designing, and conducting studies, as well as making inferences and predictions from the gathered data (Lodiko, 2010; Yates, 2004).

3. Methodology

3.1 Research Design

Descriptive research design was used in this study with the use of the questionnaire as the main instrument to gather the needed data. According to Qualtrics (n.d.), descriptive research is a research method used to try and determine the characteristics of a population or particular phenomenon. Using descriptive research one can identify patterns in the characteristics of a group to essentially establish everything one needs to understand apart from why something has happened. In addition, the descriptive research design uses a range of both qualitative research and quantitative data, although quantitative research is the primary research method to gather information to make accurate predictions about a particular problem or hypothesis.

3.2 Research Respondents

This study was conducted in Baguio Central University, Baguio City. The respondents of the study were eighty-six (86) students of the graduate and post graduate schools who were enrolled in statistics and research of Baguio Central University during the first semester of School.

3.3 Research Instruments

The researchers used the questionnaire as the main data gathering instrument for the study. The contents and/or indicators of the questionnaire were taken from primary sources such as books and other literature on statistics and research from the Internet. The questionnaire was composed of five parts which gathered the data on the following: Part I Level of importance of basic statistics in educational research.

3.4 Statistical Treatment of Data

The collected data were appropriately treated so as to facilitate their analysis, interpretation, and discussion. The four (4) point arbitrary scale with its corresponding numerical limits, descriptive interpretation and symbols were used to determine the level and weight of the responses in each of the specific questions raised in the study as follows:

1) Level of importance of basic statistics in educational research

Numerical Limits Descriptive Interpretation Symbols

4 3.26 – 4.00 Very Highly Important VHI

3 2.51 – 3.25 Highly Important HI

2 1.76 – 2.50 Moderately Important MI

1 1.00 – 1.75 Slightly Important SI

The following statistical methods were used in the investigation. To determine values relevant to statistical notions of analyses, a formula was utilized. Data transformations that assign numerical or ordinal values according to their rank after the data have been sorted are known as ranking. Inferential statistics were used in this study.

3.5 Data Gathering Procedure

Before the conduct of this study, the researchers obtained the necessary permits from the Director, ETEEAP, and from the Dean of the Engineering Department, Baguio Central University, Baguio City. A letter to the respondents was prepared requesting their participation and cooperation. Upon receiving their positive intention to participate in the study, the needed copies of the questionnaire were reproduced. The researcher personally floated the questionnaire to the respondents during their vacant time on their Saturday classes in the University. The questionnaire was retrieved after a week to give them sufficient time to consider their true responses to the questions sought. The gathered responses to the five questions of the study were tallied, summarized, and encoded.

4. Results and Discussions

Level of Importance of the Use of Basic Statistics in Educational Research

Table 1 presents the data gathered on the level of importance of basic statistics in educational research as observed by the respondents. The respondents have observed that basic statistics in educational research are very highly important as evidenced by the obtained average weighted mean of 3.66. The weighted mean of all the indicators further confirmed that basic statistics are very highly important in educational research.

Enabling the effective conduct of research topped the list of the very highly important uses of basic statistics in educational research garnering the highest weighted mean of 3.77. Similarly, basic statistics also observed as very highly important in the following descending order based on their attained weighted means: Help select proper methods to collect data, 3.72; and in making decisions and predictions, 3.70; Develop critical thinking and analytical thinking, 3.69; Help employ the correct analyses, 3.64, in drawing conclusions and inferences, 3.63; and in the effective presentation of results, 3.59; and lastly, basic statistics facilitate the evaluation of outcomes, 3.55.

| Indicators | Level of Importance | | | | TWP | WM | DE | R |
|--|---------------------|----|-----|----|-----|-------------|------------|---|
| | VMI | MI | Mol | SI | | | | |
| | 4 | 3 | 2 | 1 | | | | |
| 1. Enable effective conduct of research | 66 | 20 | 0 | 0 | 324 | 3.77 | VHI | 1 |
| 2. Help select proper methods to collect data | 62 | 24 | 0 | 0 | 320 | 3.72 | VHI | 2 |
| 3. Help employ the correct analyses | 55 | 31 | 0 | 0 | 313 | 3.64 | VHI | 5 |
| 4. Helps present results effectively | 52 | 33 | 1 | 0 | 309 | 3.59 | VHI | 7 |
| 5. Help make decisions & predictions | 60 | 26 | 0 | 0 | 318 | 3.70 | VHI | 3 |
| 6. Help draw conclusions & inferences | 56 | 28 | 2 | 0 | 312 | 3.63 | VHI | 6 |
| 7. Facilitate evaluation of outcomes | 49 | 35 | 2 | 0 | 305 | 3.55 | VHI | 8 |
| 8. Develop critical thinking & analytical thinking | 59 | 27 | 0 | 0 | 317 | 3.69 | VHI | 4 |
| Average Weighted Mean | | | | | | 3.66 | VHI | |

Figure 1. Level of Importance

These observations imply the high significance and usefulness of basic statistics in educational research and in education. Educational research is meaningless without basic statistical analyses. For graduate and post graduate students, gaining knowledge on basic statistics is very highly important because they can use or apply them when they conduct their own research works as pertinent requirements in the completion of their masters and doctorate degrees.

Basic statistics and educational research are two variables that give life and meaning to each other. Educational research is collecting and systematically analyzing information on education methods to explain them better. It should be viewed as a critical, reflexive, and professional activity that adopts rigorous methods to gather data, analyze it, and solve educational challenges to help advance knowledge (QuestionPro, n.d.), Pal (2023). On the other hand, statistics is a branch of science that deals with the collection, organization, analysis of data and drawing of inferences from the samples to the whole population (Winters, 2010). Additionally, Ali and Bhaskar (2016) explain that statistics is a valuable tool in research because it offers researchers the ability to take complex data sets, break them down and draw critical and meaningful conclusions. Statistics and its analyses give meaning to meaningless numbers, thereby giving life to lifeless numbers/data.

Furthermore, the significant influence of statistics is in educational research and in education because it helps in collecting, classifying, and tabulating all numerical facts. All the facts have a basis on comparison, description, and explanation. In the education sector, statistics help in providing accurate information for better decisions. Statistics help educators to accomplish their responsibilities, including monitoring the students and understanding the academic progress. Other reasons include ensuring quality education because educators/teachers can monitor the progress and effectiveness of their teaching subjects. Statistics are beneficial aspects in different situations to analyze data sets to make an informed decision.

Hence, statistical analysis helps in getting accurate findings for the learning process. Students can develop sampling approaches for cleaning data, handling other issues, and determining all the analysis. The quality of the learning process is dependent on different events. Statistics in research is of utmost necessity to justify research findings. Statistical methods are essential for scientific research. In fact, statistical methods dominate scientific research as they include planning, designing, collecting data, analyzing, drawing meaningful interpretation and reporting of research findings. Furthermore, the results acquired from the research project are meaningless raw data unless analyzed with statistical tools. Therefore, statistics in research is of utmost necessity to justify research findings (Iglesias, 2020), (McGraw-Taylor Harris, 2007), (Sirisilla, 2023).

Moreover, statistics also play a very important role in education such as: 1) Identify areas for improvement: Statistical analysis can help educators identify areas where students are struggling and where improvements need to be made. This information can help educators adjust their teaching methods and curriculum to better meet the needs of their students; 2) Evaluate the effectiveness of teaching methods: Statistical analysis can help educators evaluate the effectiveness of different teaching methods and interventions. For example, statistical analysis can help determine whether a specific teaching method is improving student performance or whether an intervention is having a positive impact; 3) Monitor student progress - statistical analysis can help educators monitor the progress of individual students and identify students who may need additional support or intervention. This information can help educators provide targeted support to those students and ensure that they are not left behind; 4) Optimize resource allocation: Statistical

analysis can help policymakers and school administrators optimize resource allocation by identifying which programs and initiatives are having the greatest impact on student learning outcomes. This information can help them allocate resources more effectively and efficiently; 5) Evaluate the impact of policy changes - statistical analysis can help policymakers evaluate the impact of policy changes on learning outcomes. For example, statistical analysis can help determine whether a new curriculum is improving student performance or whether changes to the school system are having the intended effect (Obiarajie, 2021).

Additionally, Zach (2022) explains that statistics is important for the following reasons: 1) Statistics allows educators to understand student performance using descriptive statistics; 2) Statistics allows educators to spot trends in student performance using data visualizations; 3) Statistics allows educators to compare different teaching methods using hypothesis tests; and 4) Statistics provides methods and techniques for collecting reliable and valid data in educational assessment. It helps in designing assessment instruments, such as tests, surveys, and questionnaires, to gather information about student knowledge, skills, and attitudes.

Therefore, the findings rejected the first assumption of the study which states that basic statistics in educational research is moderately important because the actual findings affirmed that basic statistics in educational research is very highly important as confirmed by the attained average weighted mean of 3.66.

5. Findings, Conclusions, Recommendations

5.1 Findings

1. Enabling Effective Research Conduct: Basic statistics are crucial for facilitating accurate data collection, analysis, and interpretation, with a weighted mean of 3.77.
2. Supporting Decision Making and Predictions: Basic statistics play a significant role in aiding decision-making processes and making predictions, with a weighted mean of 3.70.
3. Fostering Analytical Thinking and Presentation of Results: Basic statistics contribute significantly to the development of critical and analytical thinking skills, as well as the effective presentation of research outcomes, with weighted means ranging from 3.59 to 3.69.

5.2 Conclusions

1. The study underscores the significant importance of basic statistics in educational research among graduate and post-graduate students.
2. Respondents emphasized the crucial role of basic statistics in enabling effective research conduct, method selection, decision-making, and outcome evaluation.
3. Statistics emerged as a crucial tool in education, facilitating areas for improvement, evaluation of teaching methods, student progress monitoring, resource allocation optimization, and policy impact assessment, challenging assumptions about its moderate importance in educational research

5.3 Recommendations

1. Educational institutions should prioritize integrating basic statistics courses within graduate and post-

graduate curricula across disciplines. This ensures students acquire a strong foundation in statistical concepts and methodologies, empowering them to conduct rigorous research and make informed decisions within their fields.

2. There's a need for providing professional development opportunities aimed at enhancing educators' statistical literacy and proficiency. Workshops, seminars, and online courses focused on statistical analysis and interpretation can empower educators to effectively utilize statistical methods in their teaching practices, thereby enhancing learning outcomes for students.

3. Institutions should promote collaborative research projects involving interdisciplinary teams to foster a holistic approach to educational research. By bringing together experts from diverse fields, institutions can leverage the strengths of each discipline to address complex educational challenges and generate innovative solutions, ultimately contributing to the advancement of knowledge in education.

6. Acknowledgements

We would like to express our heartfelt gratitude to all those who have contributed to the completion of this research. We extend our sincere appreciation to the participants who generously shared their time and insights, enabling us to gather valuable data for our study. We would also like to acknowledge the guidance and support of our research supervisor, whose expertise and feedback greatly influenced the quality and direction of our research. Additionally, we are grateful to our colleagues, friends, and family for their unwavering support throughout this research journey. Their encouragement and understanding have been instrumental in our success.

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 Copyright © 2021 International Journal for Modern Trends in Science and Technology ISSN: 2455-3778 online DOI:
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