

Level of Knowledge and Skills Proficiency and Attitude of Master of Science in Teaching Mathematics Students in Statistical Data Analysis

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ABSTRACT

Although research on statistical data analysis among specialized graduate students remains limited, this study investigated the level of knowledge, skills proficiency, and attitude toward statistical data analysis among graduate students. It aims to provide a foundation to develop an academic program that can enhance the mastery of theoretical knowledge and practical applications of statistics. The study was conducted at Cagayan State University-Aparri by surveying 39 out of 54 randomly sampled graduate students enrolled from 2022 to 2025 using adopted and researcher-made online survey instruments. The study was delimited to the availability and internet access of the respondents. Generally, the study found that students demonstrated basic statistical proficiency in knowledge and skills. Although there was a stronger proficiency in fundamental statistical concepts,

students experienced greater difficulty with more advanced statistical tools particularly regression analysis. In terms of attitude, students showed a generally favorable disposition toward statistics in interest, effort, and value, while lower scores in perceived difficulty showed that advanced statistical concepts remained challenging. Also, the correlational analysis revealed that affect, value, and effort were significantly associated with specific aspects of proficiency level. While moderately positive and statistically significant relationship with $r = .433$ and $p = .006$ was found between knowledge and skills proficiency, and the overall attitude of students. The results demonstrated that stronger statistical competence may be aligned with a more positive attitude toward the subject. Therefore, the Graduate School may review and strengthen its research and statistics curriculum by incorporating additional learning activities, workshops, and statistical software training that emphasize advanced statistical techniques, particularly regression analysis, which was identified as the weakest area of proficiency among the respondents.

Keywords: *Proficiency, Statistical Data Analysis, Statistical Tools, Attitude, Graduate School*

INTRODUCTION

Statistical analysis has crucial role in the research community in communicating fact-based and accurate data. Everyone knows its importance in different fields around the world of the strong influences in making changes and providing information. Its significance in the system of learning greatly influences how educators, students, and researchers over time must be equip with this kind of skill especially now in the 21st century.

It is widely known that performing statistical analysis in a research project requires that the researcher have proficiency with concepts, methods, and the tools based on the focus of study. Statistical proficiency pertains to the statistical concepts, statistical methods, and statistical interpretations of data. This is a requirement in attempting to produce a quality research paper. The role of a student's proficiency is linked to research

competency, a study of Wongvorachan, Srisuttiyakorn, and Sriklaub (2024), who stress that statistical proficiency is often linked to the student's research competency. Similarly, a study by Padmavathy (2020) indicates that it contributes to the quality and relevance of the research results based on how strong the statistical competence of a researcher in relation to statistical analysis.

Researchers, however, demonstrate different levels of proficiency in terms of knowledge and skills depending on the amount of statistical information, experiences, and attitude possessed regarding statistical data analysis. The statistical courses and use of statistical applications such as SPSS, R, and Excel contribute to the development of statistical proficiency. And several studies in different countries show the vitality of statistical analysis skills that any researcher and even educators should not overlook.

A previous study of Lukman & Wahyudin (2020) revealed students who are exposed to statistical courses have different levels of proficiency which means students' developing proficiency level, according to the study of Diaz et al. (2024), still working on statistics competence. In Kudasale et al. (2024) study found that overall students' understanding of probability and statistical concepts is still lacking, and Gabio et al. (2025) study results show that the majority of students have low mastery of statistical concepts (53.1%) in Philippines. This finding is a problem in equipping students the skill needed to be a researcher in the 21st century education. In relation to this, students' exposures to using different statistical software explain the difficulty students encountered in conducting statistical data analysis and how students' progress from limited to proficiency in data analysis (Abbasnasab et al., 2025; Delideli, 2024). Students who are exposed in properly using the different analysis tool helps in research data analysis. And the study of Dani & Al Quraan (2023) argued that students who lack interest and confidence in statistical abilities tend to avoid using quantitative methods approaches in their study.

In higher education, postgraduate students have existing knowledge and skills in statistical analysis that are evidently displayed when fulfilling the research requirement in their courses during the undergraduate program. An education student, for example, is expected to be adept in statistical analysis, particularly mathematics major students, who are viewed as math-inclined. However, even mathematics education students and educators still encountered difficulties in doing data analysis. This problem is still a challenge in the research community. Presuming that a postgraduate is at the beginner proficiency level in statistical analysis, it does not guarantee how students dwell on the research process. There are still limited studies conducted in an attempt to explore the postgraduate level of proficiency in statistical data and their attitude as professionals in their field.

This research gap influences the researchers to conduct a study to determine the level of knowledge and skills proficiency and attitude of the students towards statistical data analysis in the graduate school of Cagayan State University Aparri, particularly focusing on the students enrolled in the Master of Science in Teaching Mathematics. It will be the first study to focus on the postgraduate's statistical analysis proficiency and attitude that provides information on the current level of proficiency of the students as well how their own attitude influences their statistical data analysis skill. The findings of the study can be the basis for policy making and continuous professional development activities.

Statement of the Problem

The primary objective of this study is to examine the level of knowledge proficiency, skills proficiency, and attitudes of Master of Science in Teaching Mathematics students in relation to statistical data analysis. Specifically, this study seeks to answer the following questions:

1. What is the profile of the MST Mathematics students in terms of the following variables?
 - a. Age
 - b. Sex
 - c. Year Graduated
 - d. Undergraduate Academic Program
 - e. Statistical Courses Taken
 - f. Attended Seminars and Trainings Related to Statistics
 - g. Prior Experience of Statistical Applications

2. What is the level of knowledge and skills proficiency of the students in statistical analysis along the following aspects?
 - a. Methods
 - b. Descriptives
 - c. Comparisons
 - d. Correlations
 - e. Regression analysis
3. What is the attitude of the students towards statistical analysis along the following components?
 - a. Affect
 - b. Cognitive Competence
 - c. Value
 - d. Difficulty
 - e. Interest
 - f. Effort
4. Is there a significant relationship among the students' level of knowledge and skills proficiency aspects and the components of attitude towards statistical analysis?

Hypotheses

This study will test the following null hypotheses.

1. There is no significant relationship among the aspects of students' level of knowledge and skills proficiency and the components of attitude towards statistical analysis.

Significance of the Study

The findings of the study will be beneficial to the following:

Graduate School Administrators (Cagayan State University - Aparri Campus): The study serves as an empirical foundation for academic leaders to design targeted interventions, specialized training programs, and research capability workshops. This directly supports efforts to continuously improve the overall statistical literacy and research readiness of graduate students across related disciplines.

Curriculum Developers and Instructional Designers: The insights provided by this study offer valuable feedback on the effectiveness of the current graduate curriculum. They can use these findings as a baseline to refine, update, or redesign course syllabi and learning modules to better address weak areas like the advanced statistical procedures and effectively bridge theoretical knowledge with practical data analysis skills.

Faculty Members and Educators: Instructors teaching graduate-level statistics and research courses can use these results to tailor their teaching strategies and pedagogical approaches. By understanding the skill gaps and the affective dimensions such as attitudes, interest, perceived difficulty of students allows educators to foster a more supportive learning environment that promotes positive attitudes toward statistics.

Graduate Students and Student Researchers: This study helps students develop self-awareness regarding their current level of statistical proficiency and encourages them to re-examine their knowledge and skills in statistical data analysis for quantitative research. Enhancing these competencies strengthens their ability to conduct quality research, interpret empirical results, and apply findings to real-world situations.

Broader Academic and Research Community: By improving the research capabilities of future educators and researchers, this study contributes to elevating the overall quality of academic output and scholarly publications, advancing evidence-based practices and supporting sustainable development goals in education.

Future Researchers: This study provides a reference and useful empirical baseline for scholars interested in conducting further research on statistical literacy, graduate education pedagogy, and the affective factors influencing statistical data analysis competence.

Literature Review

The study included related literature and studies that provides insights and findings of other researchers on the three themes namely knowledge proficiency, skill proficiency and attitude towards statistical data analysis. It highlights the importance on data analysis, and how it may influence each theme in the quantitative data analysis skill that a researcher must have in statistical data analysis.

Knowledge Proficiency in Statistical Data Analysis

Statistics is glued to the overall process of data analysis in producing a relevant finding using numerical data. Several studies showed the importance of statistics in quantitative research studies. The level of proficiency in statistical analysis begins in the cognitive stage, which involves having a deeper understanding of the statistical methods and analysis techniques. Researchers must have a high level of mastery in the key topics of statistical analysis in three categories as defined by Wongvoracharan et al. (2024).

The increasing level of mastery in the methods and handling data in statistical data analysis uses descriptive statistics, inferential statistics, and regression analysis. Also, having knowledge on the different statistical software is necessary to know which is appropriate to use making it easier for the process. Thus, this is highlighted in the study of Calma et al. (2022) that methodology serves as the study brain when it comes to research strategy and data analysis as a scientific approach.

A researcher's capability to conduct data analysis through applying what was learned in previous statistical classes affects the decision of using a specific method to progress in the interpretation of data. This is in relation to the recent study of Gabio & Cajandig (2025) outlining the substantial influences of cognitive aspects, affective and contextual factors, and the statistical mastery of a researcher in data analysis. It discusses how it influences the statistical proficiency of a researcher and illustrates how prior knowledge, attitude, self-efficacy, learning environment, resources, and the like contribute to the progress of developing mastery mirroring the level of knowledge proficiency. Hence, a recent study by Kamugisha & Arinaitwe (2024) concluded that a thorough understanding of statistical methodology is necessary for researchers to contribute to their field and improve research practices.

A warning situation that explains why knowledge proficiency in statistical analysis must not be undermined is explored by Brown (2024), emphasizing that "Higher degree research students in education are largely underprepared for understanding or employing statistical data analysis methods." Comparing this finding, Gabio & Cajandig (2025) define how contextual factors shaped the knowledge proficiency of the researcher. Researchers must know when and how to use different statistical analysis techniques as the scientific approach of rejecting or accepting hypotheses of the study. By having a strong grasp of the differences and purposes of the independent and dependent statistical tools, such as using t-tests, z-tests, ANOVA, causation and correlational analysis techniques, and the differences in using regression analysis.

Additionally, a study by Dadzie et al. (2024) outlined that limited exposure to statistical concepts gives difficulties in understanding the complexities of analysis techniques and can affect the students' performance in research. Having limited knowledge of statistical analysis can cause problems throughout the process, within themselves as the researchers and with the quality of the paper that shows the level of proficiency. Similarly, a study in Indonesia by Susbiyanto et al. (2019) emphasizing the disadvantage of having a low mastery of research statistical concepts, which leads to problems with completing assignments.

It is evident from these related studies that mastery of statistical concepts is essential in determining the level of knowledge of proficiency, whether the research is at a beginner or more advanced level of proficiency. It affects how a researcher acquires statistical analysis skills through proficiency in all aspects of statistical analysis.

Skills Proficiency in Statistical Data Analysis

Research shows that graduate students often struggle with more than just computing numbers, they also face challenges when it comes to interpreting and applying statistical results. Razak et al. (2017), for example, observed that while students could perform calculations in correlation and regression, only a small fraction interpreted them correctly. This weakness was also seen in the study of Almodal and Quintos (2025), where graduate students demonstrated stronger performance in basic mathematical knowledge but showed lower proficiency in statistical literacy and especially in data visualization. These findings point to a recurring pattern: students may be able to follow procedures, but they often fall short in transforming results into meaningful insights.

On the other hand, studies suggest that practical interventions can make a difference. Delideli (2024) found that running SPSS workshops helped mathematics students move from limited ability to a more proficient level in both test performance and data analysis literacy. This hands-on training appeared to bridge the gap between knowing formulas and actually applying them. Similarly, Amaran et al. (2022) highlighted that even students outside quantitative fields, such as those in the creative arts, recognized the need for statistical analysis skills. Their findings show that statistical competence is not just for mathematicians—it has wider relevance across disciplines. Extending this point, Wongvorachan et al. (2024) showed that the ability to grasp statistical ideas, choose suitable methods, and make sense of results was a strong predictor of overall research competence.

Taken together, these studies highlight that graduate students' skills in statistical data analysis are uneven, with consistent weaknesses in interpretation and presentation of results. At the same time, they demonstrate that targeted training, especially with statistical software, can strengthen these skills in meaningful ways. For mathematics education graduate students, the lesson is clear: proficiency in data analysis goes beyond computation and should be developed through structured practice, interpretation, and application. Strengthening these areas not only supports academic success but also equips them for more effective research and professional practice.

Attitude Towards Statistical Data Analysis

A growing body of literature highlights the central role of students' attitudes toward statistics and mathematics in shaping their engagement, learning outcomes, and willingness to adopt quantitative approaches in research. Dani and Al Quraan (2023) emphasize that one major barrier to embracing quantitative research is the lack of statistical skills, often reinforced by negative attitudes. This is consistent with León-Mantero et al. (2020), who argue that students' attitudinal components toward statistics differ depending on the degree program they pursue. Thus, instructional strategies must address these attitudinal differences to foster more positive dispositions. Similarly, Cerbito (2020) establishes a clear link between attitudes, learning, and achievement in mathematics, showing that negative perceptions correlate with lower proficiency levels. Collectively, these studies suggest that fostering constructive attitudes toward statistics is not only crucial for skill development but also for improving academic performance in related fields.

However, Uyigue (2023) complicates the relationship between attitudes and achievement, noting that not all attitudinal components predict success in statistics. While affect, cognitive competence, and effort showed no significant predictive power, value, difficulty, and interest were found to be influential. These findings point to the nuanced nature of students' attitudes and their impact on statistical learning, underscoring the importance of designing interventions that address specific attitudinal components while integrating meaningful, real-world applications to enhance students' overall engagement and achievement. Building on this, Pascual (2025) stresses that fostering positive attitudes toward statistics is crucial for developing data literacy competencies, which are increasingly essential in a data-driven society. Pascual further emphasizes the need for instruments that address students' training and evaluation in critical data interpretation, ensuring their ability to engage meaningfully with statistical information.

Taken together, the literature underscores the multifaceted nature of students' attitudes toward statistics and mathematics, highlighting the importance of targeted pedagogical interventions that not only address skill deficits but also enhance motivation, value orientation, and data literacy.

Theoretical Framework

Application of Fitts and Posner's Three-Stages Model of Skill Acquisition in Statistical Analysis

The theoretical foundation of the study is the Skill Acquisition Theory of Fitts and Posner (1967) that is modeled in three stages. Each stage contributes on the progress on acquiring skill necessary in performing a task. He explained that students progress from having existing knowledge and enhanced through practices until it reaches the advanced level. The model has the cognitive stage, associative stage and autonomous stage mirroring the level of proficiency of students over time.

The cognitive stage is about the ability to understand concepts and methods as foundation in performing a skill or task. In statistical data analysis, students must learn and master the concepts and procedures which are necessary in performing the skill or task. The exposures in several statistical courses during undergraduate studies is in this stage. This is parallel to Bloom's Taxonomy highlighting the importance of mastery of knowledge for complex thinking on statistical analysis. When students have mastery in this stage, it is easier to move in the next stage showing a good start in developing proficiency.

The associative stage is about putting into action all concepts learned. In statistical analysis, it is the how stage that student must apply their knowledge using different tools either in manual or software manner. It is the stage of refining skill with lots of errors and guidance from other people.

And the final stage is autonomous which signify the effortless application of the two stages. Students have the deeper understanding and skill in statistical data analysis as result of practices. Repeated practices and minimal guidance from others contribute in boosting confidences in statistical abilities.

The theory serves as framework of the study in relation to the level of proficiency. The first stage mirrors the knowledge proficiency of the students in statistical data analysis. Students who mastered statistical concepts reflects higher level of proficiency. Meanwhile, the second and third stage mirrors the skills proficiency in statistical data analysis. proficiency level increases over time when you reach the final stage of acquiring essential skill.

Self-Efficacy Theory in Statistical Analysis

Self-Efficacy Theory of Albert Bandura (1997) illustrates understanding of attitude towards statistical analysis. It implies how the capability of a person influences the attitude in performing a task or skill. In the context of statistics, self-efficacy affects the attitude positively or negatively depending on the sources influencing self-efficacy. These sources of self-efficacy influence whether the students develop positive or negative attitudes toward learning and applying statistical analysis. An individual's belief in their own ability is shaped by four main sources of self-efficacy, like how the study of Bathi and Sethi (2022) found that high self-efficacy leads to a positive attitude in developing skills and abilities through engaging in different activities.

The mastery experiences are personal performance accomplishments, implying that confidence increased when an individual succeeded in a statistical task. Conversely, repeated failures can lead to statistical anxiety, low motivation, or avoidance behavior.

The vicarious experiences focus on observations that an individual develops self-efficacy based on what others achieved. Individual perceive someone that is similar to themselves believe that they can succeed like that person. This emphasized the effect of observations and expectations put to others as it can influence on developing self-efficacy.

The social persuasion is related to the words of other people and how these certain words contribute to developing self-efficacy by accepting it positively or negatively. The constructive feedbacks from other affects how an individual perceived own capability to do something.

And an individual's emotional and physiological states affect their ability to perform the task. Positive thinking boosts the positive emotion of an individual leading to boosting self-efficacy and in contrary, negative thinking and emotion undermines self-efficacy.

Using self-efficacy theory as a foundation, the study examines how these four sources influence students' attitudes towards statistical analysis based on the model developed by Schau et al. (1995). The Schau et al. model evaluates attitudes through the four aspects, which are emotional response to statistics (affect), perceived ability

to understand and apply statistics (cognitive competence), perceived value relevance of statistics (value), and the perceived difficulty of learning and using statistics (difficulty).

Conceptual Framework

As students navigate to postgraduate studies, they carry with them different backgrounds and experiences after completing undergraduate academic programs and being exposed to life outside the academe. Students' freedom in enrolling in postgraduate school programs actually differs in terms of age and sex. Some enrolled immediately after completing undergraduate study, while others took more time. Also, students can be exposed to different seminars and trainings attended related to statistics and familiarity with different statistical applications that are helpful in strengthening ability in statistics. These student profiles are important in investigating statistical analysis because they are evidence that may affect the focus of the study.

Proficiency is displayed in two ways and is a result of the student's exposures and experiences in statistical analysis. Here, the study focuses on the level of proficiency in terms of knowledge and skills of the students. Through knowledge, which covers the understanding of concepts and the ability to choose appropriate methods, and through skills, which involve the use of tools, computation, and interpretation of results. The study focuses on determining the level of proficiency of students on aspects of statistical analysis, which are the methods, descriptive statistics, and inferential statistics through comparisons, correlation, and regression analysis. This will give insights to the researchers and readers into the current level of proficiency of the students based on the students' profiles.

Another, knowledge and skills do not exist in isolation that contribute to how students feel about statistics. The attitude of students towards statistics can be a barrier in mastering statistical analysis. Strong foundation often leads to confidence and a positive outlook, while gaps in understanding or ability may foster anxiety or negative attitudes. This is the focus of the study in determining the attitude of students towards statistical analysis based on the four components, namely affect, cognitive competence, value, and difficulty. By determining the attitude towards statistics, it helps in determining the significance of differences and relationships of the variables in the study.

Moreover, the paradigm of the study illustrates how the independent variables, which are the student profile, may or may not influence the dependent variables which are the level of knowledge and skills proficiency of the students in aspects of statistical analysis and the attitude towards statistics. The conceptual framework of the study attempts to determine the relationship of the level of proficiency and attitude of students in statistical analysis and significant differences of level of proficiency when grouped according to the students' profile. The framework serves as a guide for the researchers to either reject or accept the hypotheses and later be the basis for providing information that can support the results.

INDEPENDENT VARIABLES

Student's Profile

- a. Age
- b. Sex
- c. Year Graduated for Undergraduate Program
- d. Undergraduate Academic Program
- e. Statistical Courses taken
- f. Types of Attended Seminars and Trainings Related to Statistics
- g. Prior Experience of Statistical Software/applications/Tools

Attitude of the Students Towards Statistical Data Analysis

- a. Affect
- b. Cognitive Competence
- c. Value
- d. Difficulty
- e. Interest
- f. Effort

DEPENDENT VARIABLES

Level of Knowledge and Skills Proficiency of the Students in Aspects of Statistical Data Analysis

- a. Methods
- b. Descriptives
- c. Comparisons
- d. Correlations
- e. Regression Analysis



Figure 1. *Paradigm of the Study*

METHODS

The study employed appropriate statistical methods, procedure and tools in gathering and analysing data to present an accurate finding.

Research Design

The study employed a quantitative descriptive-correlational research design to determine the level of knowledge and skill proficiency as well the learners' attitude toward statistical data analysis. The students' profile characteristics, proficiency level and attitude were assessed using descriptive design. Furthermore, to assess the relationship between the students' profile characteristics, students' proficiency level, and attitude toward statistical data analysis, the correlational research design was employed.

Participants

The participants in the study were students enrolled in the Graduate School of Cagayan State University, Aparri Campus, particularly those pursuing the Master of Science in Teaching Mathematics program. The study covered students enrolled during the identified three-year period, from Academic Year 2022 to 2025. Since the program typically had a relatively small number of students enrolled each semester, the researchers considered students from the first semester, second semester, and summer term within the study period to obtain sufficient participants. Based on their availability and willingness to participate, a total of 39 students participated in the study.

Research Instrument

The study used three categories of research instrument to gather the needed data for analysis. The first category focuses on the students' profile characteristics that provides categorical data. Meanwhile, a 35-items multiple tests was used to determine the knowledge and skills proficiency of the MST-Math students if they have minimal proficiency, limited proficiency, basic proficiency, proficient, or highly proficiency. The test was a researcher-made instruments which subjected to validity assessment before using in the data gathering process through pilot testing. And an adopted questionnaire titled "Survey Attitude Towards Statistics-36 POST Version" which was constructed and validated by Schau et al. (1995). It measures the six dimensions of attitude like the effect, cognitive competence, value, difficulty, interest and effort. The said instrument was a 7-point likert scale with a rating scale of 1 (strongly disagree), 2 (disagree), 3 (somewhat disagree), 4 (neither disagree nor agree), 5 (somewhat agree), 6 (agree) and 7 (Strongly agree).

Data Gathering Procedure

Data was gathered through the permit to conduct research study through the approval process from the research adviser, Dean of Graduate School, and the Campus Executive Officer. A request letter ws submitted to get copy of enrolled students in the last three years (2022-2024) in current academic, and thesis writing. The researchers gathered raw data through online survey suing Google Form dsitributed limited to group messenger, and individual social media, and Gmail address. This procedure considered the distance of the enrolled students working in different field and areas. The data gathered was limited to this data gathering procedure which may not completed the actual data samples of the study.

Data Analysis Procedure

Descriptive and inferential statistics that were in line with the study's problem statement was used to collect data from three categories. The students' profile variables determined using descriptive statistics like frequency counts, percentages, means, and standard deviation. Overall scores of the multiple-test items were recorded to determine the overall knowledge and skills proficiency of students in relation to statistical data analysis. Also,scores in each aspect of statistical data analysis were recorded to know which aspect has highest or least proficiency level. This answered the first and second problem statements.

Moreover, the data from Likert Scale instrument will be analysed using the scoring system provided by the author of the instrument.

Component (subscale) scores on the SATS-36 are formed by

1. *Reversing the responses to the negatively worded items indicated with an asterisk*(1 becomes 7, 2 becomes 6, etc.)*
2. *Summing the item responses within each component*
3. *Dividing by the number of items within each component*

Rating Scale	Statistical Limit	Descriptive value (SATS-36)
7	6.143- 7.000	Strongly agree
6	5.286- 6.142	Agree
5	4.429- 5.285	Somewhat agree
4	3.572- 4.428	Neither disagree nor agree
3	2.715-3.571	Somewhat disagree
2	1.858- 2.714	Disagree
1	1.000-1.857	Strongly disagree

Inferential statistic like Pearson r correlation was employed to address the inferential problem statements in determining the relationship between variables. The data was analyzed using statistical software Ms Excel and Jamovi at 0.05 level of significance.

Ethical Considerations

The study secured permissions through channels in the process of conducting the study. An approved communication letter was presented before using the adopted research instrument. A consent form was presented and signed or accepted by the participants during the data gathering process to ensure that the rights of participants were protected as well as the integrity of the research study. And all information were assessed using online software tools determined if the study was subjected to plagiarism and AI Detection upon submission of the research paper.

RESULTS AND DISCUSSION

Profile of Master of Science in Teaching Mathematics Students

Personal Profile

Table 1a presents the personal profile of the respondents in terms of age, sex, year graduated from the undergraduate program, and undergraduate academic program.

Age

The mean of the age group of 29 years old, and standard deviation of 5.74 indicates a closely age for young adults as defined by the Republic Act No. 8044 (The Youth in Nation-Building Act) and the National Youth Commission. This age shows the earlier interest and attention of enrolling in masters program which mirrors professional growth in relation to the Philippine Professional Standards for Teachers. It reflects many factors why teachers as such young age pursuit graduate studies. The age level describes the earlier years of enrolling in graduate studies after the undergraduate academic program leads to intrinsic satisfaction. In which, teachers enrolled to achieve the continues goals of gaining professional growth and competence in own field of specialization.

The study revealed that 43.59% belongs to ages 22 to 26 years old, followed by ages 27 to 31 years old with 28.21%. It implies that most of the enrolled students in the aforementioned program were young adults. Meanwhile, there is at least 5.13% were enrolled that belongs to the age group of 37 to 41 years old, and 42 to 46 years respectively. The low percentage of this age group shows that some teachers pursuing masters degree as investment of the employment or promotion as changes in the public reclassification system and private institutions' qualification requirements.

Sex Distribution

In terms of sex, female respondents comprised 64.10% of the sample, while male respondents accounted for 35.90%. The difference of 28.20 percentage points indicates that female students constituted the majority of those enrolled in the Master of Science in Teaching Mathematics program during the period covered by the study.

Year Graduated in Undergraduate Program

As the age group complements the year graduated for undergraduate program with the highest percentage 35.90% of students graduated in the year 2018 to 2022, followed by 25.64% of students graduated in the year 2023 to 2027. It strongly presents the relation of how students immediate pursuit of master's degree in comparison to the list of students enrolled on the said years. It was highlighted in the study of Teves and Ubayubay (2024) that teachers enrolled in graduate studies because of the intrinsic satisfaction and societal influences. These are the following reasons which believed urges teachers to have a job security, self-motivation, financial stability, and

respect and recognition. It symbolizes how pursuing a graduate degree program impacts the teacher's quality of professional growth and personal achievements.

Undergraduate Academic Program

And it was found out that these enrolled students revealed that 92.31% possessed degree of Bachelor of Science Education Major in Mathematics showed a clear alignment in the pursuit masters degree for professional growth. On the other hand, there were at least 1 student or 2.56% of the total respondents possessed degree in BS Civil Engineering, BS Electrical Engineering, and BS Custom Administration. It indicates that the school graduate program opens it professionalism by welcoming unit earners in teaching profession, reflecting the graduate schools's mission and vision.

Table 1a. *Distribution of the respondents in terms of their personal profile in Age, Sex, Year Graduated, and Undergraduate Academic Program*

Variables	Frequency (n=39)	Percentage
<i>Age</i>		
22 to 26	17	43.59
27 to 31	11	28.21
32 to 36	7	17.95
37 to 41	2	5.13
42 to 46	2	5.13
	<i>Mean= 29 years old</i>	<i>SD= 5.74</i>
<i>Sex</i>		
Female	25	64.10
Male	14	35.90
<i>Year Graduated for Undergraduate Program</i>		
1998 to 2002	1	2.56
2003 to 2007	2	5.13
2008 to 2012	3	7.69
2013 to 2017	9	23.08
2018 to 2022	14	35.90
2023 to 2027	10	25.64
<i>Undergraduate Academic Program</i>		
BSE Mathematics	36	92.31
BS Civil Engineering	1	2.56
BS Electrical Engineering	1	2.56
BS Custom Administration	1	2.56

Courses Taken, Seminars and Trainings, and Prior Experiences of Statistical Tools

Table 1b evidently shows the profile distribution of respondents in multiple responses among the statistical courses taken, seminars and trainings attendend related to Statistics, and their prior experiences of statistical software/ applications/tools during the academic, and thesis writing for the last three years.

Courses Taken

The study revealed that students already taken Elementary Statistics and Probability and Advanced Statistics with 61.54% and 69.23% respectively. These courses are essential in equipping the students with the research and data analytics skills through mastery and proficiency of statistical data analytics. It covers such topics like descriptive statistics, methods, inferential statistics, and practical applications of concepts. The reviewed curriculum of BSE Mathematics program shows that the courses were offered as part of specialization of Mathematics Major students and integrated in the practical application of Thesis writing course. However, according to the 15.38% of respondents they have no statistics subject taken during the undergraduate program. This is a crucial gap that may influence the knowledge and skills in the students proficiency on the statistical data analysis. The result of this study creates a gap in knowledge and skills related to data analytics that should not be overlooked. In relation, the importance of these courses can contribute on how well prepared and underprepared for understanding and employing statistical methods in data analysis which similarly highlighted by the study of Brown (2024). Also, this coincides to the study of Wongvorachan, T., Srisuttiyakorn, S., & Sriklau, K. (2024) on its how the importance of theoretical knowledge of statistics concepts can predict one's competency in research or thesis writing as application of statistical data analytics skill.

Seminars and Trainings Attended

Seminars and trainings related to statistics are essential factors that supplements the knowledge and skills that can be used to statistically analysing data as part of writing a thesis or research study. The study found out that seminars and trainings commonly attended focused on descriptive statistics with 69.93% followed by inferential statistics, and sampling techniques and sample size determination with 16%. However, it shows that 5.13% attended seminars and trainings related to regression analysis. This means that there is a limited focus given to other statistical concepts necessary in analysing data that requires more than 2 group means to compare. The importance of trainings and seminars on the different aspects of Statistical Data Analytics directed to the "how" process of gathering data, analyzing, and interpreting clearly indicated in the "Methodology" of a study. This was emphasized by Calma et. al. (2022) in their study on the statistical techniques used in writing research study. If there is a limitation in the guidance from knowledgeable person or experts in concepts and statistical software/tools can be a reason why there was a minimal exposure of the different statistical methodology. It shows a minimal focus on the statistical software training with 15.38%. This shows a big gap on the focus of trainings and experiences in hands-on learning of tools. It is the result of underexplored and underexposure of other statistical software tools based on the huge difference in the percentages.

Prior Experiences in Statistical Softwares/Tools/Applications

While the study revealed that 100 % or all respondents have prior experiences in using Microsoft Excel in data analysis with features on statistical formulas easiest access and availability anywhere and anytime. Another software that commonly used was Statistics Package for Social Sciences (SPSS) which now known as IBM SPSS with 33.33%, Stata and Statistical Analysis (SAS) of 7.69 % while no prior experiences in using R Stat or the R Studio. The study showed the big gap of exposures and trainings of using these free and paid statistical softwares and tools. According to Delideli (2024), practical skills or hands on training can strengthen the data analytics skills as student becomes more confident and comfortable in using the software in computing and analysing data.

Generally, the study highlights of the importance of combining theoretical knowledge and practical applications in using different tools to analyze data using tools of descriptive or inferential statistics. The availability and access to different softwares, applications, and tools complements the courses taken and seminars attended to strengthen the skill towards statistical data analysis.

Table 1b. *Distribution of Respondents among the Statistical Courses Taken, Seminars and Trainings Attended related to Statistics, and Prior Experiences of Statistical Software/Applications/Tools*

Variables	Frequency (n=39)	Percentage
<i>Statistical Course Taken</i>		
Elementary Statistics and Probability	24	61.54
Advanced Statistics	27	69.23
No statistics subject taken	6	15.38
<i>Seminars and Trainings Related to Statistics</i>		
Descriptive Statistics	27	69.23
Inferential Statistics	16	41.03
Comparison of Groups	12	30.77
Correlation and Association	12	30.77
Regression Analysis	2	5.13
Non-parametric Tests	5	12.82
Sampling Techniques and Sample Size Determination	16	41.03
Statistical Software Training	6	15.38
Data Visualization and Presentation	5	12.82
Others	5	12.82
<i>Prior Experience of Statistical Software/Applications/Tools</i>		
Microsoft Excel	39	100
SPSS/IBM SPSS	13	33.33
R	-	
JAMOV	3	7.69
STATA	-	
Statistical Analysis (SAS)	3	7.69
Others	-	

*Multiple responses

Level of Knowledge and Skills Proficiency in Statistical Data Analysis

Students Level of Knowledge and Skills Proficiency Towards Statistical Data Analysis Along each Aspects

Table 2a presents the respondents' level of knowledge and skills proficiency across the five aspects of statistical data analysis, namely Methods, Descriptive Statistics, Comparisons, Correlations, and Regression Analysis.

Among the five aspects, Methods obtained the highest mean score ($M = 6.05$, $SD = 1.47$), interpreted as Proficient. This indicates that the respondents demonstrated relatively higher knowledge and skills in the Methods aspect than in the other four aspects of statistical data analysis. The finding suggests that the respondents possessed a stronger foundation in fundamental statistical methods, which may be associated with their previous exposure

to statistics and research courses during their undergraduate and graduate studies. However, this interpretation is limited to the competencies measured by the instrument.

In contrast, Descriptive Statistics ($M = 5.10$, $SD = 1.73$), Comparisons ($M = 5.13$, $SD = 2.14$), Correlations ($M = 5.38$, $SD = 1.70$), and Regression Analysis ($M = 4.44$, $SD = 1.92$) were all interpreted as Basic Proficiency, with Regression Analysis obtaining the lowest mean score among the five aspects. These findings indicate that although the respondents possessed the foundational knowledge and skills required to perform statistical procedures, they experienced greater difficulty in more advanced statistical analyses. Regression analysis generally requires a deeper understanding of statistical assumptions, interpretation of regression coefficients, model evaluation, and the use of statistical software, making it more challenging than descriptive and basic inferential statistical procedures.

The findings are consistent with Brown (2024), who reported that many postgraduate students remain underprepared in applying advanced statistical methods despite having previous exposure to statistics. Brown emphasized that effective statistics instruction should extend beyond computational procedures by strengthening conceptual understanding, interpretation of statistical output, and the appropriate application of statistical techniques. Likewise, Delideli (2024) found that practical training using statistical software significantly improved students' statistical test proficiency and data analysis literacy, highlighting the importance of continuous hands-on learning in developing statistical competence.

Overall, the respondents obtained a mean score of 26.18 ($SD = 7.04$), corresponding to **Basic Proficiency**. This indicates that, as a group, they possessed the fundamental knowledge and skills required for statistical data analysis but still needed further development in more advanced statistical procedures, particularly regression analysis. The variation in the respondents' proficiency across the five aspects suggests that while they demonstrated stronger competence in basic statistical methods, additional opportunities for practical application and software-assisted statistical analysis may further enhance their overall proficiency.

The findings support Fitts and Posner's Skill Acquisition Theory, which explains that learners acquire competence progressively through continuous practice and repeated application of knowledge. As graduate students gain more experience in conducting research, analyzing data, and interpreting statistical results, they are expected to progress from foundational understanding toward higher levels of statistical proficiency.

Table 2a. *Level of Knowledge and Skills Proficiency of Students towards the 35 Items Test in the following aspects.*

Variables	Mean (n=39)	SD	Decriptive Value
Methods	6.05	1.47	Proficient
Descriptives	5.10	1.73	Basic Proficiency
Comparisons	5.13	2.14	Basic Proficiency
Correlations	5.38	1.70	Basic Proficiency
Regression Analysis	4.44	1.92	Basic Proficiency
Overall	26.18	7.04	Basic Proficiency

Legend:

- Advanced Proficiency- 85% to 100 % (7 points)
- Proficient – 75% to 84% (6 points)
- Basic Proficiency – 50% to 74% (4-5 points)
- Limited Proficiency – 25 % to 49% (3 points)
- Minimal Proficiency – 24 % and below (2 points and below)

Students Level of Knowledge and Skills Proficiency Towards Statistical Data Analysis

Table 2b presents the distribution of respondents according to their overall level of knowledge and skills proficiency in statistical data analysis.

The findings revealed that the largest proportion of respondents (38.46%) attained the Advanced Proficiency level, followed by those with Basic Proficiency (30.77%), Proficient (17.95%), and Limited Proficiency (12.82%). None of the respondents were classified under the Minimal Proficiency level. These findings indicate that while a considerable number of respondents had already achieved advanced proficiency in statistical data analysis, proficiency levels varied across the group.

Despite having the highest proportion of respondents in the Advanced Proficiency category, the overall mean score of 26.18 (SD = 7.04) was interpreted as Basic Proficiency. This indicates that, collectively, the respondents possessed the foundational knowledge and skills necessary for statistical data analysis. The difference between the largest proficiency category and the overall descriptive rating suggests variability in the respondents' performance, wherein lower scores from respondents classified under the Basic and Limited Proficiency levels reduced the overall group mean.

The variation in proficiency levels further suggests that the respondents entered the graduate program with different levels of statistical preparation and prior learning experiences. These differences may be associated with variations in undergraduate coursework, exposure to statistical concepts, participation in statistics-related seminars and training, and opportunities to apply statistical techniques in research. However, these factors were not directly examined in the present study and therefore should be interpreted with caution.

The findings are consistent with Delideli (2024), who reported that students exhibit varying levels of statistical proficiency depending on their prior statistical preparation and practical experience in data analysis. The study emphasized that structured training and repeated application of statistical techniques contribute significantly to the development of statistical competence. Similarly, Brown (2024) noted that postgraduate students often demonstrate differences in statistical proficiency because of variations in their previous educational experiences and exposure to quantitative research, highlighting the importance of continuous learning and guided practice in developing advanced statistical competencies.

The findings support Fitts and Posner's Skill Acquisition Theory, which explains that learners progress from the cognitive stage toward greater proficiency through continuous practice, feedback, and repeated application of knowledge. The presence of respondents across different proficiency levels indicates that they are at different stages of statistical skill acquisition. Therefore, providing graduate students with continuous statistical training, authentic research experiences, and practical exposure to statistical software may further enhance their statistical knowledge and skills and facilitate progression toward higher levels of proficiency.

Table 2b. *Level of Knowledge and Skills Proficiency of Students Towards Statistical Data Analysis with the 35 Items Test.*

Variables	Frequency (n=39)	Percentage
Advanced Proficiency- 85% to 100 % (30-35 points)	15	38.46
Proficient – 75% to 84% (27-29 points)	7	17.95
Basic Proficiency – 50% to 74% (18-26 points)	12	30.77
Limited Proficiency – 25 % to 49% (9-17 points)	5	12.82
Minimal Proficiency – 0 to 24 % (8 points and below)	-	-
<i>Mean= 26.18 (Basic Proficiency) SD= 7.04</i>		

Attitude Towards Statistical Data Analysis

Affect

Table 3a presents the respondents' attitude toward statistical data analysis in terms of Affect, which refers to their positive and negative emotional responses toward statistics. The respondents obtained an overall mean of 4.99, interpreted as Somewhat Agree, indicating a moderately favorable attitude toward statistical data analysis. This finding suggests that the respondents generally exhibited positive emotional responses toward statistics while still experiencing some degree of anxiety, stress, and uncertainty when performing statistical tasks.

Among the indicators, "I will like statistics" obtained the highest mean score ($M = 5.67$), interpreted as Agree, followed by "I will enjoy taking statistics courses" ($M = 5.38$), also interpreted as Agree. Likewise, the reverse-scored statement "I am scared by statistics" obtained a mean score of 5.38. Since the negatively worded items were reverse-scored prior to analysis, the result indicates that the respondents generally did not perceive themselves as being scared of statistics. However, the reverse-scored statements related to feeling insecure when solving statistical problems ($M = 4.31$), becoming frustrated during statistics tests ($M = 4.56$), and experiencing stress during statistics classes ($M = 5.03$) obtained comparatively lower mean scores. These findings suggest that although the respondents generally demonstrated positive feelings toward statistics, some emotional discomfort remained when they encountered statistical problems, examinations, and classroom activities. Thus, favorable emotional responses toward statistics do not necessarily eliminate the challenges associated with learning and applying statistical concepts.

The findings are consistent with Dani and Al Quraan (2023), who reported that students with more positive attitudes toward statistics demonstrated greater confidence and willingness to engage in quantitative research and statistical learning activities. Similarly, Dodeen and Alharballeh (2025) found that students with more favorable attitudes toward statistics and higher statistics self-efficacy experienced lower levels of statistics anxiety and better academic performance. Likewise, Mendes et al. (2024) reported that students' emotional responses toward statistics, particularly statistics anxiety, were closely associated with their attitudes toward statistics and confidence in performing statistical tasks. Collectively, these studies suggest that positive emotional experiences toward statistics encourage students to participate more actively in statistical learning, although feelings of anxiety and uncertainty may still arise when dealing with more demanding statistical activities.

The findings further support Bandura's Self-Efficacy Theory, which explains that individuals' emotional and physiological states influence their beliefs about their capability to perform a particular task. Positive emotional experiences strengthen self-efficacy, whereas feelings of stress, anxiety, and frustration may reduce confidence when performing statistical analyses. Therefore, providing graduate students with supportive learning environments, meaningful practice opportunities, and constructive feedback may help reduce statistics-related anxiety while fostering more positive attitudes toward statistical data analysis.

Table 3a. Attitude Towards Statistical Data Analysis of Students along the aspect of Affect

Statement	Mean (n=39)	Descriptive Value
I will like statistics	5.67	Agree
I will feel insecure when I have to do statistics problems. *	4.31	Somewhat Disagree
I will get frustated going over statistics tests in class. *	4.56	Somewhat Agree
I will be under stress during statistics class. *	5.03	Somewhat Agree
I will enjoy taking statistics courses.	5.38	Agree
I am scared by statistics. *	5.38	Agree
Overall	4.99	Somewhat Agree

Legend:

- 6.143 -7.000 Strongly agree
- 5.286 – 6.142 Agree
- 4.429 – 5.285 Somewhat Agree
- 3.572 – 4.428 Neither Disagree nor Agree
- 2.715 – 3.571 Somewhat Disagree
- 1.858 – 2.714 Disagree
- 1.000 – 1.857 Strongly Disagree

Cognitive Competence

Table 3b presents the respondents' attitude toward statistical data analysis in terms of Cognitive Competence, which refers to their perceived ability to understand, learn, and apply statistical concepts. The respondents obtained an overall mean of 5.11, interpreted as Somewhat Agree, indicating a moderately positive perception of their cognitive competence in statistical data analysis. This finding suggests that the respondents generally believed they were capable of learning and applying statistical concepts, although they still recognized certain conceptual challenges when dealing with more advanced statistical procedures.

Among the indicators, "I can learn statistics" obtained the highest mean score ($M = 6.13$), interpreted as Agree, followed by "I will understand statistics equations" ($M = 5.72$), also interpreted as Agree. Likewise, the reverse-scored statement "I will have no idea of what is going on in this statistics course" obtained a mean score of 5.51, indicating that the respondents generally perceived themselves as capable of understanding the lessons presented in statistics courses. These findings reflect a favorable level of confidence in learning statistical concepts.

However, the reverse-scored statements "I will find it difficult to understand statistical concepts" ($M = 4.51$), "I will have trouble understanding statistics because of how I think" ($M = 4.28$), and "I will make a lot of math errors in statistics" ($M = 3.92$) obtained comparatively lower mean scores. These findings suggest that although the respondents generally believed in their ability to learn statistics, they still experienced uncertainty when dealing with more complex statistical concepts and computations. Thus, confidence in learning statistics does not necessarily eliminate the conceptual challenges encountered in statistical data analysis.

The findings are consistent with Dani and Al Quraan (2023), who reported that students with greater confidence in their statistical abilities were more likely to engage actively in statistical learning and quantitative research activities. Similarly, Wongvorachan et al. (2024) emphasized that statistical competency contributes significantly to research competence, highlighting the importance of developing students' confidence in understanding and applying statistical concepts. Likewise, Pascual (2025) emphasized that positive attitudes toward statistics enhance data literacy and strengthen students' ability to interpret and apply statistical information effectively. Collectively, these studies suggest that students' confidence in learning statistics encourages meaningful engagement in statistical learning and supports the development of research competence.

The findings further support **Bandura's Self-Efficacy Theory**, which explains that individuals who believe in their capability to accomplish a task are more likely to persist despite difficulties and perform successfully. The respondents' generally positive perception of their cognitive competence suggests that they possessed sufficient confidence to engage in statistical learning. Nevertheless, the presence of perceived conceptual difficulties highlights the need for continuous instructional support, guided practice, and authentic research experiences to further strengthen their confidence and competence in statistical data analysis.

Table 3b. Attitude Towards Statistical Data Analysis of Students along the aspect of Cognitive Competence

Statement	Mean (n=39)	Descriptive Value
I will have trouble understanding statistics because of how I think. *	4.28	Neither disagree nor agree
I will have no idea of what is going on in this statistics course. *	5.51	Agree

I will make a lot of math errors in statistics. *	3.92	Neither disagree nor agree
I can learn statistics.	6.13	Agree
I will understand statistics equations.	5.72	Agree
I will find it difficult to understand statistical concepts. *	4.51	Somewhat Agree
Overall	5.11	Somewhat Agree

Value

Table 3c presents the respondents' attitude toward statistical data analysis in terms of Value, which refers to the perceived usefulness, relevance, and importance of statistics in academic, professional, and everyday contexts. The respondents obtained an overall mean of 5.63, interpreted as Agree, indicating that they generally recognized statistics as an important discipline and acknowledged its relevance in research, professional practice, and evidence-based decision-making. This finding suggests that the respondents appreciated the practical applications of statistical knowledge beyond fulfilling academic requirements.

Among the indicators, the reverse-scored statement "Statistics is worthless" obtained the highest mean score ($M = 6.21$), interpreted as Strongly Agree. Since this negatively worded statement was reverse-scored prior to analysis, the result indicates that the respondents strongly rejected the idea that statistics is worthless. Likewise, they agreed that statistics should be a required part of professional training ($M = 6.00$), that statistical skills would enhance employability ($M = 5.85$), and that statistics is relevant to their profession and everyday life. These findings demonstrate that the respondents clearly recognized the value of statistical knowledge in supporting research activities, professional competence, and informed decision-making.

However, the reverse-scored statement "Statistics conclusions are rarely presented in everyday life" obtained the lowest mean score ($M = 4.36$), interpreted as Somewhat Agree. Since this item was reverse-scored, the result suggests that the respondents were less certain about the extent to which statistical information is encountered in everyday situations compared with its application in academic and professional settings. This finding indicates that while respondents strongly valued statistics in education and research, some may have been less aware of its routine application in daily decision-making and real-life situations.

The findings are consistent with Dani and Al Quraan (2023), who reported that students who perceived statistics as valuable were more likely to engage actively in statistical learning and quantitative research. Similarly, Wongvorachan et al. (2024) emphasized that statistical competency serves as an important predictor of research competence, highlighting the value of statistical knowledge in conducting quality research. Likewise, Pascual (2025) emphasized that recognizing the importance of statistics contributes to the development of data literacy and enhances students' ability to interpret, evaluate, and apply statistical information in academic and professional contexts. Collectively, these studies suggest that students who recognize the value of statistics are more likely to appreciate its application and develop the competencies necessary for research and evidence-based decision-making.

The findings further support Bandura's Self-Efficacy Theory, which explains that individuals are more likely to invest effort and persist in learning activities they perceive as meaningful and beneficial. When graduate students recognize the relevance of statistics to their academic and professional goals, they become more motivated to acquire statistical knowledge and apply it effectively in research. Therefore, sustaining students' appreciation of the value of statistics may strengthen their engagement in statistical learning and contribute to the continuous development of their research competence.

Table 3c. Attitude Towards Statistical Data Analysis of Students along the Value Aspect

Statement	Mean (n=39)	Descriptive Value
Statistics is worthless. *	6.21	Strongly Agree
Statistics should be required part of my professional training.	6.00	Agree
Statistical skills will make me more employable.	5.85	Agree
Statistics is not useful to the typical professional. *	6.00	Agree
Statistical thinking is not applicable in my life outside my job. *	5.67	Agree
I use statistics in my everyday life.	5.33	Agree
Statistics conclusions are rarely presented in everyday life. *	4.36	Somewhat Agree
I will have no application for statistics in my profession. *	5.44	Agree
Statistics is irrelevant in my life. *	5.85	Agree
Overall	5.63	Agree

Difficulty

Table 3d presents the respondents' attitude toward statistical data analysis in terms of difficulty which refers to their perception of how challenging statistics is to learn and apply. The respondents obtained an overall mean of 3.44, interpreted as Somewhat Disagree, indicating that the Difficulty dimension received the least favorable rating among the six attitude dimensions. This finding suggests that although the respondents generally demonstrated positive attitudes toward statistics, they continued to perceive certain statistical concepts and procedures as relatively challenging.

Among the indicators, "Statistics formulas are easy to understand" obtained the highest mean score ($M = 4.74$), interpreted as Somewhat Agree, indicating that the respondents generally believed statistical formulas could be understood with appropriate instruction and practice. Likewise, the reverse-scored statement "Statistics is a complicated subject" obtained a mean score of 4.64, suggesting that the respondents did not strongly perceive statistics as overwhelmingly complicated.

On the other hand, the reverse-scored statements "Learning statistics requires a great deal of discipline" ($M = 2.15$), "Statistics involves massive computations" ($M = 2.44$), "Most people have to learn a new way of thinking to do statistics" ($M = 2.72$), and "Statistics is highly technical" ($M = 3.13$) obtained comparatively lower mean scores. Since these statements were reverse-scored prior to analysis, the results suggest that the respondents still recognized the intellectual demands of learning statistics, particularly in terms of analytical thinking, conceptual understanding, and the application of statistical procedures. These findings indicate that although the respondents generally possessed favorable attitudes toward statistics, they continued to perceive certain aspects of statistical learning as challenging.

The findings are consistent with Dani and Al Quraan (2023), who reported that students' confidence in learning statistics influences how they approach statistical tasks and their willingness to engage in quantitative research. Similarly, Mendes et al. (2024) found that students' perceptions of the difficulty of statistics were closely associated with statistics anxiety and self-efficacy, with students demonstrating greater confidence tending to perceive statistical learning as more manageable. Brown (2024) likewise emphasized that postgraduate students often encounter challenges when learning advanced statistical methods because of the conceptual complexity of statistical analysis. However, the study highlighted that guided instruction, repeated practice, and authentic research experiences help students overcome these challenges and strengthen their competence in statistical data

analysis. Collectively, these studies suggest that while statistics may initially be perceived as challenging, continuous learning experiences and practical application can improve students' confidence and reduce the perceived difficulty of the subject.

The findings further support Bandura's Self-Efficacy Theory, which explains that individuals' beliefs about their capabilities influence how they approach challenging tasks. Students with stronger self-efficacy are more likely to persist despite difficulties and view challenging statistical tasks as opportunities for learning rather than barriers to success. Therefore, providing graduate students with continuous practice, constructive feedback, and authentic opportunities to apply statistical techniques may help reduce perceived difficulty while strengthening their confidence and competence in statistical data analysis.

Table 3d. Attitude Towards Statistical Data Analysis of Students along the aspect of Difficulty

Statement	Mean (n=39)	Descriptive Value
Statistics formula are easy to understand.	4.74	Somewhat Agree
Statistics is a complicated subject. *	4.64	Somewhat Agree
Statistics is a subject quickly learned by most people.	4.23	Neither disagree nor agree
Learning statistics requires a great deal of discipline. *	2.15	Disagree
Statistis involves massive computations. *	2.44	Disagree
Statistics are highly technical. *	3.13	Somewhat Disagree
Most people have to learn a new way of thinking to do statistics. *	2.72	Somewhat Disagree
Overall	3.44	Somewhat Disagree

Interest

Table 3e presents the respondents' attitude toward statistical data analysis in terms of Interest, which refers to their willingness and enthusiasm to learn, understand, and apply statistical concepts. The respondents obtained an overall mean of 5.87, interpreted as Agree, indicating a high level of interest toward statistical data analysis. This finding suggests that the respondents were generally motivated to develop their statistical knowledge and skills and recognized the importance of statistics in their academic and professional pursuits.

Among the indicators, "I am interested in learning statistics" obtained the highest mean score ($M = 6.26$), interpreted as Strongly Agree, followed by "I am interested in using statistics" ($M = 5.82$) and "I am interested in understanding statistical information" ($M = 5.77$), both interpreted as Agree. Likewise, the respondents agreed that they were interested in communicating statistical information to others ($M = 5.64$). These findings indicate that the respondents demonstrated a strong willingness not only to acquire statistical knowledge but also to apply and communicate statistical information in academic and professional settings. Such responses reflect a genuine interest in statistics as an essential component of research and evidence-based practice.

The findings are consistent with Dani and Al Quraan (2023), who reported that students with greater interest and more positive attitudes toward statistics were more likely to engage actively in statistical learning and quantitative research activities. Similarly, Wongvorachan et al. (2024) emphasized that research competence is strengthened through continuous engagement in statistical learning and the practical application of statistical concepts. Likewise, Pascual (2025) highlighted that fostering students' interest in statistics contributes to the development of data literacy and enhances their ability to interpret, evaluate, and apply statistical information effectively. Collectively, these studies suggest that students' interest serves as an important motivational factor that encourages continuous learning and meaningful engagement in statistical data analysis.

The findings further support Bandura's Self-Efficacy Theory, which explains that individuals who value a learning task and believe in their capability to perform it are more likely to invest effort, persist despite challenges, and achieve successful learning outcomes. The respondents' high level of interest reflects a favorable disposition toward learning statistics, which may encourage the continuous development of their statistical knowledge, analytical skills, and research competence.

Table 3e. Attitude Towards Statistical Data Analysis of Students along the aspect of Interest

Statement	Mean	Descriptive Value
I am interested in being able to communicate statistical information to others.	5.64	Agree
I am interested in using statistics.	5.82	Agree
I am interested in understanding statistical information.	5.77	Agree
I am interested in learning statistics.	6.26	Strongly Agree
Overall	5.87	Agree

Effort

Table 3f presents the respondents' attitude toward statistical data analysis in terms of Effort, which refers to their willingness to invest time and exert effort in learning statistics. The respondents obtained an overall mean of 5.80, interpreted as Agree, indicating a positive commitment toward learning statistics. This finding suggests that the respondents recognized the importance of exerting consistent effort in developing their statistical knowledge and skills and were willing to fulfill the academic responsibilities associated with learning statistical concepts.

Among the indicators, "I plan to attend every statistics class session" obtained the highest mean score ($M = 6.21$), interpreted as Strongly Agree, followed by "I plan to complete all of my statistics assignments" ($M = 5.82$), "I plan to study hard for every statistics test" ($M = 5.64$), and "I plan to work hard in my statistics course" ($M = 5.54$), all interpreted as Agree. These findings indicate that the respondents were willing to participate actively in statistics classes, complete academic requirements, and devote time to learning statistical concepts. Such responses reflect a strong commitment toward engaging in learning activities that support the development of statistical knowledge and research skills.

The findings are consistent with Dani and Al Quraan (2023), who reported that students who actively participated in statistical learning activities and exerted greater effort demonstrated more positive attitudes toward statistics and were more likely to engage in quantitative research. Similarly, Wongvorachan et al. (2024) emphasized that research competence is strengthened not only through conceptual knowledge but also through continuous practice and active involvement in statistical learning activities. Likewise, Pascual (2025) highlighted that sustained student engagement and active participation contribute to the development of data literacy and enhance students' ability to interpret and apply statistical information effectively. Collectively, these studies suggest that students' willingness to invest effort in learning statistics supports continuous learning and facilitates the development of statistical knowledge and research competence.

The findings further support Bandura's Self-Efficacy Theory, which explains that individuals with stronger beliefs in their capabilities are more likely to invest effort, persist despite challenges, and accomplish learning goals successfully. The respondents' willingness to attend classes, complete assignments, and prepare for statistical assessments reflects a positive behavioral disposition toward learning statistics. Therefore, maintaining students' motivation and providing supportive learning experiences may further strengthen their commitment to learning and facilitate the continuous development of their statistical competence.

Table 3f. *Attitude Towards Statistical Data Analysis of Students along the aspect of Effort*

Statement	Mean(n=39)	Descriptive Value
I plan to complete all of my statistic assignments.	5.82	Agree
I plan to work hard in my statistics course.	5.54	Agree
I plan to study hard for every statistics test.	5.64	Agree
I plan to attend every statistics class session.	6.21	Strongly Agree
Overall	5.80	Agree

Summary of Students Attitude Towards Statistical Data Analysis

Table 3g summarizes the respondents' attitude toward statistical data analysis across the six dimensions, namely Affect, Cognitive Competence, Value, Difficulty, Interest, and Effort. The respondents obtained an overall mean of 5.14, interpreted as Somewhat Agree, indicating a generally favorable attitude toward statistical data analysis. This finding suggests that the respondents recognized the importance of statistics, demonstrated interest and willingness to learn statistical concepts, and were committed to exerting effort in developing their statistical knowledge and skills. However, the findings also indicate that they continued to experience some emotional and cognitive challenges, particularly when dealing with more complex statistical concepts and procedures.

Among the six dimensions, Interest obtained the highest mean score ($M = 5.87$), followed by Effort ($M = 5.80$) and Value ($M = 5.63$), all interpreted as Agree. These findings indicate that the respondents were highly motivated to learn statistics, recognized its relevance to their academic and professional development, and were willing to invest time and effort in acquiring statistical knowledge and skills. In contrast, Difficulty obtained the lowest mean score ($M = 3.44$), interpreted as Somewhat Disagree, suggesting that although the respondents generally held favorable attitudes toward statistics, they continued to perceive certain statistical concepts and analytical procedures as challenging. Meanwhile, Affect ($M = 4.99$) and Cognitive Competence ($M = 5.11$), both interpreted as Somewhat Agree, indicate that while the respondents generally possessed positive emotional responses and confidence toward learning statistics, some degree of anxiety, uncertainty, and conceptual difficulty remained.

The findings are consistent with Dani and Al Quraan (2023), who reported that positive attitudes toward statistics encourage students to participate actively in statistical learning and quantitative research. Similarly, Wongvorachan et al. (2024) emphasized that research competence is strengthened through continuous engagement in statistical learning and the development of statistical competency. Likewise, Pascual (2025) highlighted those positive attitudes toward statistics contribute to the development of data literacy and enhance students' ability to interpret, evaluate, and apply statistical information effectively. Collectively, these studies suggest that favorable attitudes toward statistics encourage meaningful engagement in learning and support the continuous development of statistical knowledge and research competence.

The findings further support Bandura's Self-Efficacy Theory, which explains that individuals who possess positive beliefs about their capabilities, recognize the value of a learning task, and are willing to invest effort are more likely to persist despite challenges and achieve successful learning outcomes. The respondents' generally favorable attitudes across the six dimensions indicate a positive learning disposition that may facilitate the continuous development of their statistical knowledge, analytical skills, and research competence. Nevertheless, the comparatively lower rating for the Difficulty dimension suggests that graduate programs should continue providing instructional support, authentic research experiences, and opportunities for practical statistical application to further strengthen students' confidence and reduce the perceived challenges associated with statistical data analysis.

Table 3g. *Attitude Towards Statistical Data Analysis of Students along the Six Aspects*

Statement	Mean (n=39)	Descriptive Value
Affect	4.99	Somewhat Agree
Cognitive Competence	5.11	Somewhat Agree
Value	5.63	Agree
Difficulty	3.44	Somewhat Disagree
Interest	5.87	Agree
Effort	5.80	Agree
Overall	5.14	Somewhat Agree

Relationship between Students' Level of Knowledge and Skills Proficiency, and Attitude Towards Statistical Data Analysis Along Each Dimensions

Affect and the Six Aspects of Level of Knowledge and Skills Proficiency

Table 4a presents the relationship between the respondents' affect toward statistics and their level of knowledge and skills proficiency in statistical data analysis. The findings revealed that Affect had a low positive and statistically significant relationship with Methods ($r = .396$, $p = .013$) and Descriptive Statistics ($r = .435$, $p = .006$). However, no significant relationships were found between Affect and Comparisons ($r = .311$, $p = .054$), Correlations ($r = .288$, $p = .075$), and Regression Analysis ($r = .210$, $p = .468$), as all probability values exceeded the 0.05 level of significance. These findings indicate that respondents with more favorable emotional responses toward statistics tended to demonstrate higher proficiency in fundamental statistical concepts, particularly in selecting appropriate statistical methods and performing descriptive statistical analyses. However, affect was not significantly associated with proficiency in more advanced statistical procedures.

The significant relationships observed in Methods and Descriptive Statistics suggest that positive emotional experiences toward statistics may encourage students to engage more actively in learning foundational statistical concepts. Students who enjoy learning statistics and experience less anxiety may be more willing to participate in classroom discussions, complete learning activities, and practice basic statistical procedures. In contrast, the absence of significant relationships with Comparisons, Correlations, and Regression Analysis suggests that developing proficiency in more advanced statistical techniques may depend more on conceptual understanding, repeated practice, and practical experience than on emotional disposition alone.

The findings are consistent with Dani and Al Quraan (2023), who reported that students with more positive attitudes toward statistics were more likely to participate actively in statistical learning and quantitative research activities. Similarly, Delideli (2024) emphasized that practical statistical training and hands-on learning experiences strengthen students' statistical literacy and analytical skills by increasing their engagement with statistical concepts. Likewise, Wongvorachan et al. (2024) highlighted that research competence is strengthened through continuous learning, statistical competency, and the practical application of statistical methods. Collectively, these studies suggest that positive emotional responses toward statistics encourage active engagement in learning, which is associated with stronger proficiency in fundamental statistical concepts.

The findings further support Bandura's Self-Efficacy Theory, which explains that individuals' emotional states influence their confidence and willingness to engage in learning tasks. Students who experience more positive emotions toward statistics are more likely to participate actively in statistical learning and persist despite challenges. However, acquiring proficiency in more advanced statistical procedures requires not only favorable attitudes but also continuous practice, guided instruction, and authentic research experiences. Therefore, graduate programs should provide supportive learning environments and practical statistical learning opportunities to strengthen both students' confidence and their proficiency in statistical data analysis.

Table 4a. *Correlation statistics between the Level of Knowledge and Skills Proficiency, and Attitude Towards Statistical Data Analysis along aspects of Affect.*

Variable	r-value	Probability	Inference
*Attitude Towards Statistical Data Analysis			
Affect			
*Level of Knowledge and Skills Proficiency			
Methods	.396	.013	Significant
Descriptive	.435	.006	Significant
Comparisons	.311	.054	Not Significant
Correlations	.288	.075	Not Significant
Regression Analysis	.210	.468	Not Significant

*tested at 0.05 level of significance

Cognitive Competence and the Six Aspects of Level of Knowledge and Skills Proficiency

Table 4b presents the relationship between the respondents' cognitive competence and their level of knowledge and skills proficiency in statistical data analysis. The results revealed that no statistically significant relationship existed between cognitive competence and any of the five aspects of statistical proficiency, namely Methods ($r = .256$, $p = .116$), Descriptive Statistics ($r = .287$, $p = .077$), Comparisons ($r = .266$, $p = .101$), Correlations ($r = .197$, $p = .229$), and Regression Analysis ($r = .168$, $p = .305$), as all probability values were greater than the 0.05 level of significance. Although all correlation coefficients were positive, they indicated only weak associations. These findings suggest that the respondents' perceived ability to understand and learn statistics was not significantly associated with their measured level of knowledge and skills proficiency in statistical data analysis.

The absence of significant relationships indicates that confidence in learning statistics alone may not necessarily correspond to higher proficiency in performing statistical procedures. Although the respondents generally believed that they were capable of understanding statistical concepts, actual proficiency may depend on other factors such as prior statistical training, repeated practice, exposure to research activities, and opportunities to apply statistical techniques in authentic research settings. This finding suggests that positive perceptions of one's cognitive competence should be complemented by continuous learning experiences to strengthen statistical knowledge and skills.

The findings are consistent with Brown (2024), who reported that postgraduate students often experience difficulties in applying advanced statistical procedures despite having prior knowledge of statistical concepts. Similarly, Delideli (2024) emphasized that practical statistical training and hands-on learning experiences are essential in transforming conceptual understanding into statistical competence. Likewise, Wongvorachan et al. (2024) highlighted that research competence is strengthened through the continuous application of statistical knowledge and skills in research activities rather than through conceptual understanding alone. Collectively, these studies suggest that while confidence in learning statistics is important, the development of statistical proficiency depends largely on sustained practice and meaningful application of statistical concepts.

The findings support Fitts and Posner's Skill Acquisition Theory (1967), which explains that acquiring knowledge represents only the initial stage of skill development. Learners progress toward proficiency through repeated practice, feedback, and experience before achieving competent performance. Therefore, graduate programs should complement conceptual instruction with authentic research activities, statistical software training, and practical data analysis exercises to help students translate their perceived cognitive competence into measurable statistical proficiency.

Table 4b. Correlation statistics between the Level of Knowledge and Skills Proficiency, and Attitude Towards Statistical Data Analysis along aspects of Cognitive Competence

Variable	r-value	Probability	Inference
*Attitude Towards Statistical Data Analysis			
Cognitive Competence			
*Level of Knowledge and Skills Proficiency			
Methods	.256	.116	Not Significant
Descriptive	.287	.077	Not Significant
Comparisons	.266	.101	Not Significant
Correlations	.197	.229	Not Significant
Regression Analysis	.168	.305	Not Significant

*tested at 0.05 level of significance

Value and the Six Aspects of Level of Knowledge and Skills Proficiency

Table 4c presents the relationship between the respondents' perceived value of statistics and their level of knowledge and skills proficiency in statistical data analysis. The findings revealed a low positive and statistically significant relationship between Value and Methods ($r = .371, p = .020$). However, no significant relationships were found between Value and Descriptive Statistics ($r = .300, p = .063$), Comparisons ($r = .275, p = .090$), Correlations ($r = .174, p = .289$), and Regression Analysis ($r = .057, p = .732$), as all probability values exceeded the 0.05 level of significance. These findings indicate that respondents who placed greater value on statistics tended to demonstrate higher proficiency in selecting appropriate statistical methods. However, the perceived value of statistics was not significantly associated with proficiency in performing other statistical procedures.

The significant relationship between Value and Methods suggests that respondents who recognized the importance and usefulness of statistics were more likely to appreciate the role of selecting appropriate statistical techniques in conducting research. Since choosing the correct statistical method is a fundamental step in data analysis, respondents who valued statistics may have been more attentive to understanding this aspect of research. In contrast, the absence of significant relationships with the other aspects indicates that recognizing the importance of statistics alone may not necessarily correspond to higher proficiency in performing descriptive, inferential, correlational, or regression analyses. Developing competence in these statistical procedures may require continuous practice, conceptual understanding, and opportunities to apply statistical techniques in authentic research settings.

The findings are consistent with Uyigue (2023), who reported that students who recognized the value and relevance of statistics demonstrated greater engagement in statistical learning and more positive learning experiences. Similarly, Wongvorachan et al. (2024) emphasized that research competence is strengthened not only by appreciating the importance of statistics but also through the continuous application of statistical concepts in research activities. Likewise, Pascual (2025) highlighted that recognizing the value of statistics contributes to the development of data literacy and enhances students' ability to interpret, evaluate, and apply statistical information effectively. Collectively, these studies suggest that valuing statistics encourages students to build a strong foundation in statistical concepts, although mastery of more advanced statistical procedures depends on sustained learning and practical application.

The findings further support Bandura's Self-Efficacy Theory (1997), which explains that individuals are more likely to engage in learning activities they perceive as meaningful and beneficial. Graduate students who recognize the value of statistics may be more motivated to learn fundamental statistical concepts, particularly those related to selecting appropriate research methods. Nevertheless, developing proficiency in more advanced statistical procedures requires continued practice, guided instruction, and repeated opportunities to apply statistical

techniques in research. Therefore, graduate programs should provide authentic research experiences and practical statistical training to help students translate their appreciation of statistics into higher levels of statistical competence.

Table 4c. *Correlation statistics between the Level of Knowledge and Skills Proficiency, and Attitude Towards Statistical Data Analysis along aspects of Value.*

Variable	r-value	Probability	Inference
*Attitude Towards Statistical Data Analysis			
Value			
*Level of Knowledge and Skills Proficiency			
Methods	.371	.020	Significant
Descriptive	.300	.063	Not Significant
Comparisons	.275	.090	Not Significant
Correlations	.174	.289	Not Significant
Regression Analysis	.057	.732	Not Significant

*Tested at 0.05 level of significance

Difficulty and the Six Aspects of Level of Knowledge and Skills Proficiency

Table 4d presents the relationship between the respondents' perceived difficulty of statistics and their level of knowledge and skills proficiency in statistical data analysis. The findings revealed that no statistically significant relationship existed between Difficulty and any of the five aspects of statistical proficiency, namely Methods ($r = .119$, $p = .470$), Descriptive Statistics ($r = .244$, $p = .135$), Comparisons ($r = .104$, $p = .530$), Correlations ($r = -.058$, $p = .725$), and Regression Analysis ($r = .083$, $p = .614$), as all probability values exceeded the 0.05 level of significance. Although the correlation coefficients ranged from negligible to low, none reached statistical significance. These findings indicate that the respondents' perception of the difficulty of statistics was not significantly associated with their measured level of knowledge and skills proficiency in statistical data analysis.

The absence of significant relationships suggests that perceiving statistics as difficult does not necessarily correspond to lower proficiency in statistical data analysis. Likewise, respondents who perceived statistics as less difficult did not necessarily demonstrate higher levels of statistical proficiency. This finding implies that statistical competence may be influenced by factors beyond perceived difficulty, such as prior statistical knowledge, quality of instruction, opportunities for practice, exposure to research activities, and the application of statistical concepts in authentic learning situations.

The findings are consistent with Dani and Al Quraan (2023), who reported that although students' perceptions of statistics may influence their engagement in learning activities, these perceptions do not necessarily correspond to their actual performance in statistical tasks. Similarly, Brown (2024) found that postgraduate students often encounter challenges when applying advanced statistical procedures despite having prior exposure to statistical concepts, indicating that perceived difficulty and actual competence are not always directly associated. Likewise, Delideli (2024) emphasized that practical statistical training, continuous practice, and authentic learning experiences are more influential in developing statistical competence than students' perceptions of task difficulty. Collectively, these studies suggest that mastery of statistical concepts depends primarily on sustained learning experiences and practical application rather than on perceived difficulty alone.

The findings support Fitts and Posner's Skill Acquisition Theory (1967), which explains that skill development progresses through repeated practice, feedback, and experience rather than through learners' perceptions of task difficulty. Although students may initially perceive statistical concepts as challenging during the cognitive stage of learning, continuous engagement in statistical learning activities enables them to gradually

develop competence. Therefore, graduate programs should continue providing authentic research experiences, practical statistical exercises, and opportunities to apply statistical techniques to help students strengthen their statistical proficiency regardless of their perceived level of difficulty.

Table 4d. Correlation statistics between the Level of Knowledge and Skills Proficiency, and Attitude Towards Statistical Data Analysis along aspects of Difficulty.

Variable	r-value	Probability	Inference
<i>*Attitude Towards Statistical Data Analysis</i>			
Difficulty			
<i>*Level of Knowledge and Skills Proficiency</i>			
Methods	.119	.470	Not Significant
Descriptive	.244	.135	Not Significant
Comparisons	.104	.530	Not Significant
Correlations	-.058	.725	Not Significant
Regression Analysis	.083	.614	Not Significant

*Tested at 0.05 level of significance

Interest and the Six Aspects of Level of Knowledge and Skills Proficiency

Table 4e presents the relationship between the respondents' interest toward statistical data analysis and their level of knowledge and skills proficiency in the different aspects of statistical data analysis. The findings revealed low to moderate positive and statistically significant relationships between Interest and Methods ($r = .333, p = .038$), Descriptive Statistics ($r = .419, p = .008$), Comparisons ($r = .322, p = .045$), and Correlations ($r = .411, p = .009$). However, no statistically significant relationship was found between Interest and Regression Analysis ($r = .044, p = .789$). These findings indicate that respondents with greater interest in statistics tended to demonstrate higher proficiency in fundamental and intermediate statistical procedures. However, interest was not significantly associated with proficiency in regression analysis.

The significant relationships observed with Methods, Descriptive Statistics, Comparisons, and Correlations suggest that respondents who were more interested in statistics were more likely to engage actively in learning activities that strengthened their understanding of commonly used statistical procedures. Students with greater interest may be more willing to participate in classroom discussions, complete statistical exercises, and explore statistical concepts, which may contribute to higher proficiency in these aspects. In contrast, the absence of a significant relationship between Interest and Regression Analysis suggests that proficiency in more advanced statistical procedures may depend not only on students' interest but also on conceptual understanding, extensive practice, statistical software skills, and opportunities to apply regression techniques in research.

The findings are consistent with Dani and Al Quraan (2023), who reported that students with more positive attitudes toward statistics were more likely to engage actively in statistical learning and quantitative research activities. Similarly, Wongvorachan et al. (2024) emphasized that research competence is strengthened through continuous engagement in statistical learning and the practical application of statistical concepts. Likewise, Pascual (2025) highlighted those positive attitudes toward statistics promote the development of data literacy and enhance students' ability to interpret, evaluate, and apply statistical information effectively. Collectively, these studies suggest that students' interest in statistics encourages active engagement in learning, which is associated with stronger proficiency in fundamental statistical concepts and research-related skills.

The findings further support Bandura's Self-Efficacy Theory (1997), which explains that individuals who are interested in a learning task and believe in their capability to perform it are more likely to invest effort, persist despite challenges, and engage actively in learning activities. Students who demonstrate greater interest in statistics are therefore more likely to participate in meaningful learning experiences that strengthen their statistical

knowledge and skills. Nevertheless, developing proficiency in advanced statistical procedures, such as regression analysis, requires not only interest but also sustained practice, guided instruction, and authentic opportunities to apply statistical techniques in research.

Table 4e. *Correlation statistics between the Level of Knowledge and Skills Proficiency, and Attitude Towards Statistical Data Analysis along aspects of Interest.*

Variable	r-value	Probability	Inference
<i>*Attitude Towards Statistical Data Analysis</i>			
Interest			
<i>*Level of Knowledge and Skills Proficiency</i>			
Methods	.333	.038	Significant
Descriptive	.419	.008	Significant
Comparisons	.322	.045	Significant
Correlations	.411	.009	Significant
Regression Analysis	.044	.789	Not Significant

*Tested at 0.05 level of significance

Effort and the Six Aspects of Level of Knowledge and Skills Proficiency

Table 4f presents the relationship between the respondents' effort toward statistical data analysis and their level of knowledge and skills proficiency across the different aspects of statistical data analysis. The findings revealed low to moderate positive and statistically significant relationships between Effort and Methods ($r = .400$, $p = .012$), Descriptive Statistics ($r = .321$, $p = .046$), Comparisons ($r = .417$, $p = .008$), and Correlations ($r = .344$, $p = .032$). However, no statistically significant relationship was found between Effort and Regression Analysis ($r = .137$, $p = .406$). These findings indicate that respondents who reported exerting greater effort in learning statistics tended to demonstrate higher proficiency in fundamental and intermediate statistical procedures. However, effort was not significantly associated with proficiency in regression analysis.

The significant relationships observed with Methods, Descriptive Statistics, Comparisons, and Correlations suggest that respondents who consistently invested time and effort in learning statistics were more likely to engage actively in learning activities that strengthened their understanding of commonly used statistical procedures. Regular participation in class activities, completion of learning tasks, and preparation for statistical assessments may provide students with more opportunities to reinforce statistical concepts and develop practical analytical skills. In contrast, the absence of a significant relationship between Effort and Regression Analysis suggests that proficiency in more advanced statistical procedures may depend not only on students' willingness to exert effort but also on conceptual understanding, statistical software proficiency, guided instruction, and repeated opportunities to apply regression techniques in research.

The findings are consistent with Dani and Al Quraan (2023), who reported that students who actively engaged in statistical learning activities demonstrated greater confidence and participation in quantitative research. Similarly, Wongvorachan et al. (2024) emphasized that research competence is strengthened through continuous engagement in statistical learning and the practical application of statistical concepts. Likewise, Pascual (2025) highlighted that sustained engagement in learning activities contributes to the development of data literacy and enhances students' ability to interpret, evaluate, and apply statistical information effectively. Collectively, these studies suggest that students' willingness to invest effort in learning statistics is associated with stronger statistical knowledge and research-related competencies.

The findings further support Fitts and Posner's Skill Acquisition Theory (1967), which explains that skill development progresses through continuous practice, feedback, and repeated performance. As learners repeatedly apply statistical concepts in different learning situations, they gradually progress from basic understanding to

higher levels of proficiency. Therefore, graduate programs should continue providing students with authentic research experiences, practical statistical exercises, and opportunities to use statistical software to strengthen their competence in statistical data analysis, particularly in more advanced statistical procedures.

Table 4f. Correlation statistics between the Level of Knowledge and Skills Proficiency, and Attitude Towards Statistical Data Analysis along aspects of Effort.

Variable	r-value	Probability	Inference
*Attitude Towards Statistical Data Analysis			
Effort			
*Level of Knowledge and Skills Proficiency			
Methods	.400	.012	Significant
Descriptive	.321	.046	Significant
Comparisons	.417	.008	Significant
Correlations	.344	.032	Significant
Regression Analysis	.137	.406	Not Significant

*Tested at 0.05 level of significance

Summary of Correlation Statistics between Level of Knowledge and Skills Proficiency, and Attitude towards Statistical Data Analysis

Table 4g presents the relationship between the respondents' overall level of knowledge and skills proficiency and their overall attitude toward statistical data analysis. The findings revealed a moderate positive and statistically significant relationship ($r = .433$, $p = .006$) at the 0.05 level of significance. Therefore, the null hypothesis stating that there is no significant relationship between students' level of knowledge and skills proficiency and their attitude toward statistical data analysis is rejected. The findings indicate that respondents with higher levels of statistical knowledge and skills tended to exhibit more favorable attitudes toward statistical data analysis.

The significant positive relationship suggests that students' statistical knowledge and skills proficiency were associated with their overall attitude toward statistics. Respondents who demonstrated higher proficiency generally exhibited greater interest, recognized the value of statistics, and reported stronger willingness to exert effort in learning statistical concepts. Likewise, respondents with more favorable attitudes toward statistics tended to demonstrate better proficiency in several fundamental aspects of statistical data analysis, particularly methods, descriptive statistics, comparisons, and correlations, as reflected in the preceding correlation analyses. Although not all dimensions of attitude were significantly associated with every aspect of statistical proficiency, the overall findings suggest that statistical knowledge and positive attitudes are closely related and may reinforce one another throughout the learning process.

The findings are consistent with Dani and Al Quraan (2023), who reported that positive attitudes toward statistics were associated with greater engagement in statistical learning and quantitative research activities. Similarly, Wongvorachan et al. (2024) emphasized that research competence is strengthened through the continuous development and application of statistical knowledge and skills. Likewise, Pascual (2025) highlighted those favorable attitudes toward statistics contribute to the development of data literacy and enhance students' ability to interpret, evaluate, and apply statistical information effectively. Collectively, these studies suggest that statistical competence and positive attitudes toward statistics are complementary factors that support effective learning and successful research practice.

The findings further support Bandura's Self-Efficacy Theory (1997), which explains that successful learning experiences strengthen individuals' beliefs in their capabilities, resulting in greater confidence,

persistence, and motivation to engage in similar learning tasks. Students who develop stronger statistical knowledge and skills are more likely to approach statistical learning with confidence and positive attitudes, while favorable attitudes may encourage continued engagement in statistical learning activities. Therefore, graduate programs should provide meaningful statistical instruction, authentic research experiences, and opportunities for practical application to simultaneously strengthen students' statistical competence and foster more favorable attitudes toward statistical data analysis.

Table 4g. Correlation statistics between the Level of Knowledge and Skills Proficiency, and Attitude Towards Statistical Data Analysis

Variable	r-value	Probability	Inference
*Attitude Towards Statistical Data Analysis	.433	.006	Significant
*Level of Knowledge and Skills Proficiency			

*Tested at 0.05 level of significance

Summary

This study determined the relationship between the level of knowledge and skills proficiency and attitude toward statistical data analysis among Master of Science in Teaching Mathematics students. The findings revealed that the respondents were predominantly young female graduates of the Bachelor of Secondary Education major in Mathematics who had prior exposure to statistics courses, with Microsoft Excel being the most commonly used statistical software. Overall, the respondents demonstrated Basic Proficiency in statistical data analysis, with the highest proficiency observed in Methods, while Regression Analysis obtained the lowest proficiency level. In terms of attitude, the respondents exhibited a generally favorable attitude toward statistical data analysis, with Interest, Effort, and Value receiving the highest ratings, whereas Difficulty obtained the lowest rating, indicating that advanced statistical concepts were still perceived as challenging. Correlation analysis showed that Affect, Value, Interest, and Effort were significantly associated with selected aspects of statistical knowledge and skills proficiency, while Cognitive Competence and Difficulty showed no significant relationships with any proficiency aspect. Overall, a moderate positive and statistically significant relationship ($r = .433$, $p = .006$) was found between students' level of knowledge and skills proficiency and their attitude toward statistical data analysis, indicating that respondents with more favorable attitudes generally demonstrated higher levels of statistical competence.

CONCLUSION

The findings of the study revealed that Master of Science in Teaching Mathematics students generally possessed a basic level of knowledge and skills proficiency in statistical data analysis while exhibiting a generally favorable attitude toward statistics, particularly in terms of interest, effort, and recognizing its value. Although the respondents demonstrated stronger proficiency in fundamental statistical concepts, they experienced greater difficulty with more advanced statistical procedures, particularly regression analysis. Moreover, selected dimensions of attitude, specifically Affect, Value, Interest, and Effort, were significantly associated with certain aspects of statistical knowledge and skills proficiency, whereas Cognitive Competence and Difficulty were not. Overall, the study established a moderate positive and statistically significant relationship between students' level of knowledge and skills proficiency and their attitude toward statistical data analysis, indicating that more favorable attitudes toward statistics are generally associated with higher levels of statistical competence. Therefore, enhancing both statistical competence and positive attitudes toward statistics is essential in preparing graduate students to conduct sound quantitative research.

Recommendations

In the light of the aforementioned findings and conclusions of the study, the following are highly recommended:

1. **The Graduate School** may review and strengthen its research and statistics curriculum by incorporating additional learning activities, workshops, and statistical software training that emphasize advanced statistical techniques, particularly regression analysis, which was identified as the weakest area of proficiency among the respondents.
2. **Statistics instructors and research advisers** may provide more authentic and practice-oriented learning experiences by integrating real research datasets, case-based statistical problems, and guided statistical software applications into instruction. These activities may help bridge the gap between students' favorable attitudes toward statistics and their actual statistical proficiency.
3. **Graduate students** are encouraged to continuously enhance their statistical competence through independent study, participation in statistical seminars and workshops, and regular practice using statistical software. Since students already demonstrated positive interest and willingness to learn, these favorable attitudes should be translated into continuous skill development through consistent application in research.
4. **The Graduate School and faculty members** may continue to cultivate students' positive attitudes toward statistical data analysis by creating supportive learning environments that encourage active participation, meaningful feedback, collaborative learning, and confidence in applying statistical techniques, particularly in more advanced statistical procedures.
5. **Future researchers** may replicate this study using larger samples from different graduate programs or higher education institutions to improve the generalizability of the findings. They may also investigate other variables, such as statistical self-efficacy, statistics anxiety, prior research experience, statistical software proficiency, and instructional approaches, or evaluate intervention programs designed to improve both statistical competence and attitudes toward statistical data analysis.

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